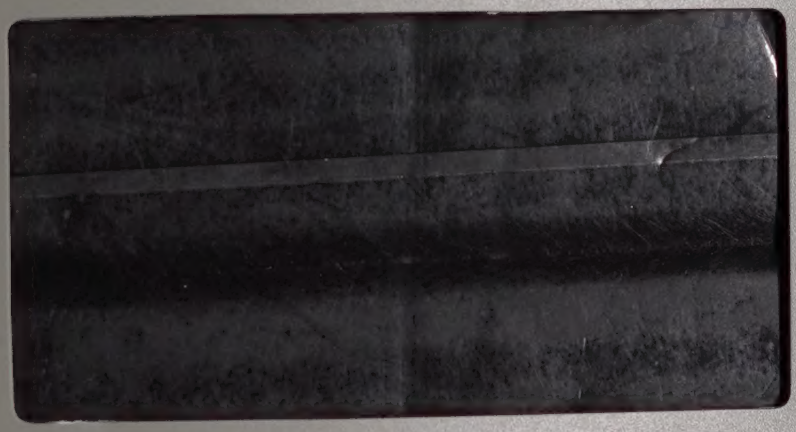

GE Rental/Lease

Rental Accessory

Failure to return this item will result in a minimum charge of $100.00

1-800-GE-RENTS

GE-11

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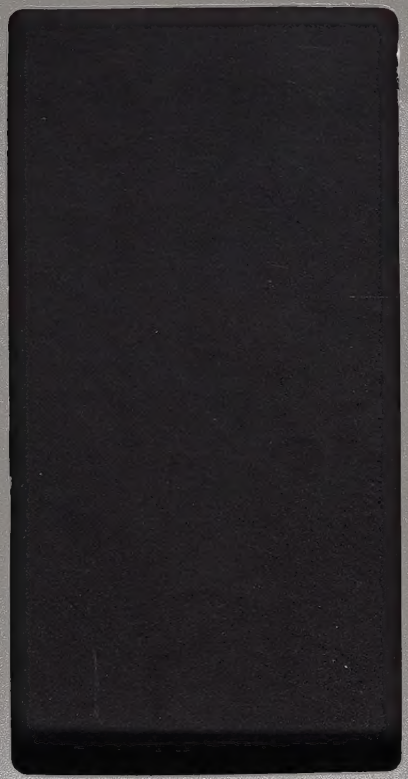


VALHALLA SCIENTIFIC, INC.

MODEL 4300B/4350ATE
DIGITAL MICRO-OHMMETER

OPERATION MANUAL

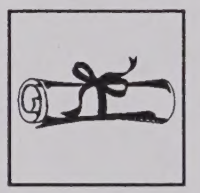
VALHALLA SCIENTIFIC

9955 MESA RIM ROAD
SAN DIEGO, CA 92121
(619) 457-5576
(619) 457-0127 Fax

CERTIFICATION

Valhalla Scientific, Inc. certifies that this instrument was thoroughly tested and inspected and found to meet published specifications when shipped from the factory. Valhalla Scientific, Inc. further certifies that its calibration measurements are traceable to the National Institute of Standards and Technology to the extent allowed by NIST's calibration facility.

WARRANTY



The warranty period for this instrument is stated on your invoice and packing list. Please refer to these to determine appropriate warranty dates. We will repair or replace the instrument during the warranty period provided it is returned to Valhalla Scientific, Inc. freight prepaid. No other warranty is expressed or implied. We are not liable for consequential damages. Permission and a return authorization number must be obtained directly from the factory for warranty repairs. No liability will be accepted if returned without such permission. Due to continuing product refinement and due to possible parts manufacturer changes, Valhalla Scientific reserves the right to change any or all specifications without notice.

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SECTION I UNPACKING & INSTALLATION

1-1. Introduction

The Model 4300B is a unique instrument capable of handling even the toughest resistance measurement applications. The 4300B is designed to measure the low resistance of such items as coils, transformers, ballasts, heater elements, etc. Some features of the 4300B that give it an edge over competitive products are:

- ✓ "Charging Inductor" mode for rapid settling times.
- ✓ "Disconnect Status" indicators designed with safety in mind.
- ✓ Full 4-wire Kelvin terminal configuration.
- ✓ Fully selectable test currents up to 10 amps.
- ✓ Available locking rear Bendix connectors.
- ✓ Available data outputs and remote programming capability.
- ✓ Available high-speed version for assembly lines (4350ATE).

These features and more are discussed fully in the operating instructions of this manual. **This device may be dangerous if used in a manner contrary to its design!** Please read this manual thoroughly before operating your 4300B (4350ATE).

1-2. Initial Inspection

If the shipping carton is damaged, request that the carrier's agent be present when the unit is unpacked. If the instrument appears damaged, the carrier's agent should authorize repairs before the unit is returned to the factory. Even if the instrument appears undamaged, it may have suffered internal damage in transit that may not be evident until the unit is operated or tested to verify conformance with its specifications. If the unit fails to operate or fails to meet the performance specifications of Section 2, notify the carrier's agent and the nearest Valhalla Sales Office. Retain the shipping carton for the carrier's inspection. DO NOT return equipment to Valhalla Scientific or any of its sales offices prior to obtaining authorization to do so.

1-3. Line Voltage/Fuse Selection

The only adjustments required before placing the unit in operation are to set the rear panel switch to the correct local AC line voltage and verify that the proper fuse for this voltage is installed as follows:

105 to 125 VAC = 3 Amp Slo-blo
210 to 250 VAC = 1 Amp Slo-blo

1-4. Instructions for Bench Use

The unit is supplied with all the hardware required for bench use and special instructions for use in this manner are not necessary. However, before connecting the unit to the local power source, verify that the power cord is equipped with a three-terminal connector (see the Safety Precautions of paragraph 1-6).

1-5. Rack Mounting

Optional brackets are available for mounting the Model 4300B (4350ATE) in a standard 19" equipment rack. These are listed in Section 3. The size of the unit

and the location of its center of gravity dictate that it must be supported on both sides along its entire length through the use of trays or slides. If it is to be transported while mounted in a rack, it should be supported so as to prevent upward or downward movement.

It is recommended that blank panels at least 1.75 inches high be installed between this and any other units in the rack to ensure freedom of air flow. Under no circumstances should the ambient air temperature around the unit exceed 50°C while the unit is in operation or 70°C when power is removed.

1-6. Safety Precautions

The power plug must be a three-contact device and should be inserted only into a three-contact mating socket where the third contact provides a ground connection. If power is provided through an extension cable, the ground connection must be continuous. **Any discontinuity in the ground lead may render the unit unsafe for use!**

The Model 4300B (4350ATE) employs forced air cooling of the internal components. This operates continuously and care must be taken to ensure that the intake and exhaust ports remain clear. **Blocked vents may cause a dangerous overheating condition!**

SECTION II SPECIFICATIONS

2-1. General

This section contains accuracy and operational specifications for the Model 4300B. See Addendum 10-1 for the 4350ATE High-Speed Digital Micro-ohmmeter specification changes. The accuracy specifications are valid for a period of one year from the date of calibration at a temperature of 22°C to 28°C. Outside this range, the temperature coefficient specification applies.

Accuracy:	±.04% of reading ±3 digits (add ±3 digits on 20mV range; ±.02% of reading on 10A range)
Temperature Coefficient:	(5°C-21°C and 29°C-50°C) ±.005% of reading per °C
Temperature Sensors:	"AL" and "CU" add ±.05% of reading to accuracy specification (Temperature compensators are accurate to ±0.1% of the rated coefficient)
CMR Ratio:	60dB at DC, 50Hz, and 60Hz
Display:	4½ digit (19999) Liquid Crystal Display
Overload Indication:	Display Flashes -1
Terminal Configuration:	Four-wire Kelvin
Conversion Rate:	Approximately 400 milliseconds
Maximum Kick-Back Protection:	500 Amps Peak Induced Current
Compliance Voltage (Normal Mode):	7.5 VDC nominal at 10A resistive
Compliance Voltage (Charging Inductor Mode):	> 20 VDC when indicator is lit
Open Circuit Voltage (Test Current Off):	< 20mV between I_{HI} and I_{LO} terminals

TABLE 2-1. Ranges and Resolutions

Resistance Ranges	Resolution		Full Scale Voltage 20mV	200mV	2V
2mΩ	100nΩ		10A	---	---
20mΩ	1μΩ		1A	10A	---
200mΩ	10μΩ	**Test**	100mA	1A	10A
2Ω	100μΩ	**Current**	10mA	100mA	1A
20Ω	1mΩ	**Range:**	1mA	10mA	100mA
200Ω	10mΩ		100μA	1mA	10mA
2KΩ	100mΩ		---	100μA	1mA
20KΩ	1Ω		---	---	100μA

TABLE 2-2. Environmental, Power, and Physical Requirements

Environmental

Operating Temperature Range: 0 to 50°C
Humidity: 70% RH at 40°C non-condensing
Storage Temperature Range: -30°C to 70°C

Power Requirements

Power Supply Voltage: 105-125 or 210-250 VAC
Power Supply Frequency: 50 - 60 Hz
Power Supply Consumption: 200VA Maximum

Physical

Dimensions: 17"(43cm)W x 17"(43cm)D x 4"(10cm)H
Weight: 9.1Kg (20 lbs) NET; 11.8Kg (26 lbs) SHIPPING

3-1. Available Options

Listed below are the options available for use with the Model 4300B and 4350ATE Digital Micro-ohmmeters.

Option RX-3: Rack Ears

Option "RX-3" is a set of rack ears that permit mounting of the instrument in a standard 19" equipment rack.

Option TL-488: IEEE Interface

Option "TL-488" is an IEEE-488 GPIB Talk-Listen interface that allows control via the IEEE-488 Bus for remote range programming and resistance measurement data acquisition. See Section 5.

Options GP-1, GP-2: GPIB Cable

1 *or* **2** *meter IEEE-488 GPIB interface cable for use with Option TL-488.*

Option BCD: Data Outputs

Option "BCD" is a parallel binary-coded-decimal data interface with outputs for display and range data. See Section 6.

Model 1248: Dual-Limit Comparator

The Valhalla Model 1248 may be used in conjunction with a Model 4300B and Option BCD above. The Model 1248 is a dual-limit comparator that interprets the display indications of the 4300B as either "HI", "LO" or "GO", based on a window that is set by the user. Relay contact closure is provided to trigger an alarm, batch sorter, counter or other device. The mating cable from the 4300B to the 1248 is 2½ feet in length and designated as "IDC-3".

Option IDC-3: BCD Interface Cable

Option IDC-3 is an interface cable designed specifically to connect the 4300B BCD output to the inputs of the Model 1248 BCD Comparator. It is 2½ feet in length and is terminated on one end in a 50 pin Amphenol connector with wire break-outs, and on the other end in a 24 pin Amphenol connector that mates with the BCD output port of the 4300B. See drawing number 4300-051 at the back of this manual.

Option RS232: Serial Interface

The ohmmeter is now available with an optional serial interface designed to be compatible with RS232C systems. This interface may be used for remote data acquisition only, and does not allow mode or range control. If this option has been installed, please refer to Section 10 for operating instructions.

Option AL: Aluminum Compensator

Option "AL" is a compensating temperature sensor for aluminum (4030 ppm/°C) providing a 20°C or 25°C reference.

Option CU: Copper Compensator

Option "CU" is a compensating temperature sensor for copper (3931 ppm/°C) providing a 20°C or 25°C reference.

Option CK: Extension Cable

Option "CK" is a 4' shielded extender cable that permits the placement of Options "AL"/"CU" in closer proximity to the resistor under test.

3-2. Test Leads

Option K: General-Purpose Lead Set

Option "K" is a shielded, 4-wire Kelvin cable set, forty-eight inches in length terminated in "KCS" gold-plated clips.

Option KCS: Gold-Plated Clips

Option "KCS" is a light-weight, gold-plated Kelvin clip set for 4-wire measurements on smaller components and leads. Clips open to 1/2 inch and accommodate test currents of up to 10 amperes.

Option KK: Heavy-Duty Cable Set

Option "KK" is a heavy-duty 4-wire Kelvin cable set, 48-inches in length terminated in "JAWS" clamps for connecting to large motors, bushings, etc. Opening is 2". A variation of this cable set is Option "KL" which is 10 feet in length.

Option JAWS: Heavy-Duty Clamps

Option "JAWS" are the heavy-duty clamps used to terminate Option "KK".

Option MP-1: Kelvin Micro-Probes

Option "MP-1" is a 48-inch shielded Kelvin 4-wire cable set with a 1-ampere test current capacity employing a set of Kelvin Micro-Probes. The probes are equipped with stainless steel V-1 tips separated by 0.05 inches.

Option MP-2: Kelvin Mini-Probes

Option "MP-2" is a 48-inch shielded 4-wire cable set equipped with Kelvin Mini-Probes having spring loaded stainless steel tips. The V-1 tips are separated by 0.18 inches. Test current capacity is 10 amperes.

Option MP-4/MP-5: Surface Probes

These probes permit rapid, repeatable bonding testing on a variety of screened or flat surfaces. Test current is evenly distributed through the probe base while sensing is accomplished via a spring loaded center contact. The MP-4 target area is 1" in diameter. The MP-5 target area is .4" in diameter. The current capacity of both probes is 10 amperes.

Option JB-2: Rear Bendix Connectors

Option "JB-2" is a set of rear-mounted positive-mating locking Bendix *style connectors. The mating cable set is Option "KC". See drawing number 4300-407 at the back of this manual.*

Option KC: Bendix Cable Set

Option "KC" is a heavy-duty 4-wire Bendix *style lead set. Option KC must be used with Option JB-2 above.*

Option BBL: Banana-to-Banana Cable

Option "BBL" is a 48" shielded cable terminated in dual banana plugs. This cable may be used for voltage and current connections to the ohmmeter.

Option SL-48: Low-Thermal Leads

Option "SL-48" is a 48" shielded lead set terminated in gold-plated spade lugs. This lead set is designed to eliminate problems caused by thermal EMF's and is rated for the maximum output current of the instrument.

Option C: Banana-to-Clip Cable

Option "C" is a 48" general-purpose shielded lead set terminated on one end in a dual banana plug and on the other end in red and black copper alligator clips.

4-1. General

This section of the manual contains complete instructions for manually operating the 4300B Digital Micro-Ohmmeter.

4-2. Connections

Connections to the 4300B are made via 4 heavy-duty binding posts on the front panel. When using Valhalla test leads, the tabbed side of each banana jack is connected to the **current** terminals (see below). This ensures that current is carried in the largest conductor of the cable, and that the voltage input is shielded. A set of rear mounted terminals is available as Option JB-2.

V_{HI}* *I_{HI} ←Tab

V_{LO}* *I_{LO} ←Tab

NOTE: If the input terminals are not connected to a load (open), the display will roll around and may or may not indicate an overrange. This is a characteristic of the voltmeter and does not indicate a fault in the instrument.

The four-terminal configuration of the 4300B eliminates errors normally caused by test lead and contact resistances. In many applications the contact resistance can exceed the value of the load by several orders of magnitude. The 4300B bypasses this potential error source by providing two terminals of constant current and an additional two terminals for high impedance voltage measurement. The result is a fast, accurate resistance measurement of the load, independent of the resistance of the current carrying leads.

Figure 4-1 illustrates how the 4-wire principle is used to eliminate lead, wire and contact resistances as potential error sources. The internal current source inherently overcomes all series resistance (within compliance voltage limits) and delivers a precise constant current. The internal high-impedance DVM senses the voltage drop across the load. There is negligible contact and lead resistance error created by the voltage measurement because the high input impedance of the DVM limits current flow in the voltage leads.

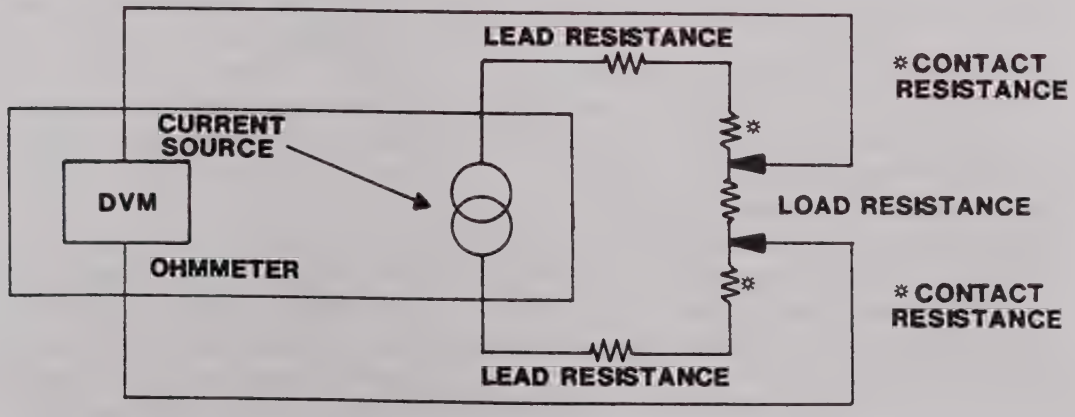


Figure 4-1. Error Sources in Resistance Measurement

4-3. Setting Voltage and Test Current

The Full Scale Voltage is selected via three interlocking push-buttons. Three LED's directly above the push-buttons indicate which range has been selected. The Test Current is selected via a six-position rotary switch. Six LED's mounted to the left of the switch determine the resistance range that will be displayed as indicated by the front panel matrix. The resistance range is found on the matrix at the intersection of the Voltage Range and Current Range LED's.

The test current may be turned off and on via the front panel Test Current switch, by a command from the IEEE interface board, or by a remote switch using Option "RS" as described in Section 3. An LED positioned directly above the Test Current switch indicates the status of the current source.

4-4. Charging Inductor Mode

The Charging Inductor mode LED indicates when the standard current source compliance voltage of 7 volts is exceeded. In this situation the 4300B provides a booster shot in excess of 20V to reduce the settling time when a large inductive load is being measured. The display readings should be ignored when this LED is illuminated.

4-5. Cable Disconnect Status Indicators

The SAFE and UNSAFE LED's indicate whether or not it is safe to disconnect the test leads from the load. When a highly inductive load is being measured, a potentially lethal back-EMF is induced when the test current is removed. The 4300B provides a discharge path for this back-EMF and monitors the voltage. The SAFE LED is illuminated when the back-EMF is less than five volts.

CAUTION: Although the 4300B is protected against up to 500 Amps of inductive kickback, it is not advisable to remove test leads with the Test Current On, or with the UNSAFE LED lit. In some extreme applications if leads are removed or pull loose before the SAFE LED is lit, damage may occur to the 4300B and/or injury to the operator!

The UNSAFE LED is also illuminated whenever a test current of .1A or greater is selected and the Test Current is turned On, regardless of the load.

4-6. Temperature Compensation

Automatic Temperature Compensation (ATC) simulates a constant ambient temperature chamber for materials which are normally subject to varying ambient temperatures. When the ATC mode is selected, the temperature sensor (Options "AL" and "CU") automatically senses the ambient temperature and compensates the reading to indicate what the actual resistance value would be in a controlled 20°C or 25°C environment.

The ATC mode is selected by pressing the Temperature Compensation On push-button. An LED positioned directly above this push-button indicates that this mode has been selected. The temperature sensors are connected to the 4300B via the front panel BNC connector. The temperature sensor may be extended with an Option "CK" compensator extension cable. The FAULT indicator is illuminated when the ATC mode is selected if the temperature sensor connections are not intact.

CAUTION: The housing of the compensator is electrically connected to the internal circuitry of the instrument (ground), and to the V_{LO} terminal. Care must be taken so that the housing does not contact live circuitry.

SECTION V REMOTE OPERATION

5-1. General

This section of the manual contains instructions for operating the Digital Micro-Ohmmeter via the GPIB (IEEE-488) interface, if installed. For information regarding remote operation via the RS232C serial, please refer to Section 10.

5-2. The Purpose of IEEE Standard 488

The purpose of the standard is to allow for interconnection of programmable instruments with a minimum of engineering. The intent is to remove the need for adapters and the numerous types of patching cables often encountered with other forms of interfaces. The IEEE-488 standard defines a system configuration for programmable instruments such as calculators, voltmeters and other types of peripheral devices produced by various manufacturers. It provides a set of rules for establishing a defined communications link with a high degree of compatibility yet maintaining flexibility between independently manufactured products.

5-3. Definitions

Listed below are definitions of the terms used to describe the IEEE-488 interface:

Bus: A data link which is usually a set of several parallel wires within a multi-wire cable.
Bi-Directional Bus: A "highway" used for two-way communication, with input and output data being carried on the same lines.
Bit-Parallel: A data transmission method in which all of the bits composing an item of data are present simultaneously on a group of wires in a bus.
Byte: A group of eight data bits which is treated as a single item of data.
Byte-Serial: A data transmission method in which information, in bit-parallel bytes, is transferred sequentially between devices.
Device Dependent Message: A message containing commands or data intended for a specific device.
Handshake: An exchange of signals between two devices which is used to control the transfer of data between them.
Interface: The part of an instrument or system which enables it to be connected to another via a bus.
Interface Message: A message intended for interface management.
Local Operation: Operation of a device by its front panel controls (also referred to as Manual Control).
Remote Operation: Operation of device under the control of another via the bus.

5-4. Bus Restrictions

The IEEE-488 Interfacing Standard (also known as IEC DTC66 (WG3), ANSI MC1-1, GPIB, HP-IB, etc.), defines a bidirectional bus for interconnecting programmable instrumentation in a bit-parallel, byte-serial fashion. It defines limitations as follows:

1. A maximum of 15 devices may be interconnected by a single bus.
2. The total bus length may not exceed 20 meters, with a maximum interconnection length of 4 meters.
3. Maximum transmission rate is 1 megabyte per second.
4. All bus data is digital.

Of the devices on the bus, only *one* may be the controller which exercises control over all other devices, and is also capable of operating as a talker or listener. The other devices may be listeners (only able to receive data) or talkers (only able to send data), or both. The model 4300B is capable of talking and listening. The controller may address other devices and command them to listen or talk. Only one device may talk at any one time.

The interconnecting cable consists of sixteen signal wires and eight ground returns linking devices into a complete system:

1. Eight data wires (DIO-0 thru DIO-7)

2. Five management wires (ATN, EOI, SRQ, IFC, and REN)

3. Three "handshake" wires (DAV, NRFD and NDAC)

Each cable connector is a plug/socket combination to permit "daisy-chaining" of units. It should be noted that these wires use "inverse logic". That is to say that a low level indicates the true (asserted) state and a high level indicates a false (non-asserted) state.

5-5. Detailed Descriptions of Bus Operations

The five management wires are described as follows:

ATN: Asserted by the controller whenever an address or a command is present on the bus.

EOI: May be asserted by the controller or any talker. With ATN true, EOI indicates that the controller is polling devices. With ATN false, EOI is asserted by the talker to indicate the end of data.

SRQ: May be asserted by any device. This indicates that the device requires attention (e.g., a fault has occurred). Normally, the controller will respond by polling to determine which device requires service.

IFC: May be asserted only by the controller. This line initializes the bus to a reset state.

REN: May be asserted only by the controller. This signal places the addressed device into the remote mode.

The three handshake wires are described as follows:

DAV: May be asserted by any talker; indicates that a valid data byte is present on the data wires.

NRFD: May be asserted by any listener. Indicates that the listener is not ready to receive data.

NDAC: May be asserted by any listener. Indicates that the listener has not yet finished reading the data byte.

The transfer of data on the bus is controlled by these three handshake wires. It is important to note that the drivers for the handshake wires are all connected for wired-on operation. That is, as long as any of the devices on the bus asserts a handshake line, it will remain true. There must be a complete consensus among the devices for any handshake wire to be high (false).

The talker first waits for all devices to be ready to accept data (checks that NRFD is false) then puts one byte of data on the bus and asserts DAV. It waits for all devices to indicate that the data has been accepted (that is, NDAC to become false) before starting to transfer the next byte of data. This handshake protocol assures that

data on the bus is transferred at the speed of the slowest device on the bus.

Data is sent in 8-bit bytes on the DIO wires, usually (as in the 4300B) using the ISO-7 standard ASCII characters. Table 5-1 lists each ASCII character and the bus messages applicable to each.

Note that the table is divided into two main groups; the primary command group and the secondary command group. The secondary command group is not utilized in the 4300B.

The primary command group is further divided into four subgroups as follows:

1. **Addressed Command Group** - applied only to addressed devices.

2. **Universal Command Group** - applied to all devices.

3. **Listen Address Group** - set of device listen addresses.

4. **Talk Address Group** - set of device talk addresses.

Data in the above command groups is sent with ATN "true". These type of commands are understood by all devices using the IEEE-488 standard. When data is sent with ATN "false", it is referred to as a *device dependent* command. A device dependant command is specific to a particular device, and may or may not be understood by other devices.

ISO BIT & DIO LINE NUMBER ▶ 7 6 5 4 3 2 1	0 ASCII	0 MSG	1 ASCII	1 MSG	2 ASCII	2 MSG	3 ASCII	3 MSG	4 ASCII	4 MSG	5 ASCII	5 MSG	6 ASCII	6 MSG	7 ASCII	7 MSG	ROW ▼
0 0 0 0	NUL		DLE		SP	00	0	16	@	00	P	16	`		p		0
0 0 0 1	SOH	GTI	DC 1	LLO	!	01	1	17	A	01	Q	17	a		q		1
0 0 1 0	STX		DC 2		"	02	2	18	B	02	R	18	b		r		2
0 0 1 1	ETX		DC 3		#	03	2	19	C	03	S	19	c		s		3
0 1 0 0	EOT	SDC	DC 4	DCI	$	04	4	20	D	04	T	20	d		t		4
0 1 0 1	ENQ	PPC'	NAK	PPU	%	05	5	21	E	05	U	21	c		u		5
0 1 1 0	ACK		SYN		&	06	6	22	F	06	V	22	f		v		6
0 1 1 1	BEL		ETB		'	07	7	23	G	07	W	23	g		w		7
1 0 0 0	BS	GET	CAN	SPE	(	08	8	24	H	08	X	24	h		x		8
1 0 0 1	HT	TCT	EM	SPD	)	09	9	25	I	09	Y	25	i		y		9
1 0 1 0	LF		SUB		*	10	:	26	J	10	Z	26	j		z		10
1 0 1 1	VT		ESC		+	11	;	27	K	11	[	27	k		{		11
1 1 0 0	FF		FS		,	12	<	28	L	12	\	28	l		|		12
1 1 0 1	CR		GS		-	13	=	29	M	13	]	29	m		}		13
1 1 1 0	SO		RS		.	14	>	30	N	14	^	30	n		~		14
1 1 1 1	SI		US		/	15	?	UNL	O	15	_	UNT	o		DEL		15

COLUMN ▶

STANDARD ISO 7 CHARACTERS

ADDRESSED COMMAND GROUP (ACG) | UNIVERSAL COMMAND GROUP (UCG) | LISTEN ADDRESS GROUP (LAG) | TALK ADDRESS GROUP (TAG) | SECONDARY COMMAND GROUP (SCG)

PRIMARY COMMAND GROUP (PCG)

'Requires Secondary Command

Notes:

1 Device Address messages shown in decimal

2 Message codes are

DCI	Device Clear	LLO	Local Lockout	SDC	Selected Device Clear
GET	Device Trigger	PPC	Parallel Poll Configure	SPD	Serial Poll Disable
GTI	Go to Local	PPU	Parallel Poll Unconfigure	SPE	Serial Port Enable

Table 5-1. ASCII Character Codes

ASCII CODE:	V_X	I_X	Q_X	D_X	C_X
X					
0	20mV	0.1mA	No SRQ	CR LF terminator	Test Current OFF
1	200mV	1mA	SRQ On I/P Error	CR LF w/EOI	Test Current ON
2	2V	10mA	SRQ On New Rdg	CR	
3		100mA		CR w/EOI	
4		1A			
5		10A			

S	Triggers single reading	L	Returns to Local
T	Indicates continuous reading mode	A	Selects ATC mode On
N	Selects normal mode (ATC off)	E	Request Configuration Status word (See Below)

After sending "E", the next data read will contain information regarding present 4300B status. For example:

Q_n	Present SRQ status
V_n	Present voltage range
I_n	Present current range
S	S for single reading, T for continuous reading mode
N	Normal mode, A for ATC
D_n	CR LF @ END DATA
C_n	Test current status
U	"U" indicates UNSAFE to disconnect cables; a space indicates SAFE
H	"H" indicates that the unit is in Charging Inductor mode; a space indicates not charging
F	"F" indicates a fault in the ATC; a space indicates no ATC fault

No further readings will be taken until "E" is read

Table 5-2. 4300B Commands (Device Dependent)

5-6. Theory of Operation

All IEEE-488 device dependent activity with the 4300B takes place via input and output buffers.

Input Buffer - Incoming data is placed in the input buffer as it is received. It is not acted upon until any one of the valid input delimiters is received. Then the commands are decoded and the input buffer contents erased. Should an invalid character be found in the input buffer, the buffer is only decoded up to the error, the rest being discarded. An SRQ may be asserted, if required, should this occur. See Section 5-9.

The valid input delimiters are:

CR (Carriage Return) or
EOI with the last character.

Output Buffer - With every display update (except fault messages), the output buffer is filled with the contents of the 4300B display. This data may be read by the controller at the rate of 2½ readings per second (12½ rdg/sec for 4350ATE).

The **listen address** of the 4300B is set by means of a five-pole switch on the rear of the unit. The address is set using a binary-weighted code from 1 through 30. See Section 5-10.

At power-up the 4300B will be in the local mode (i.e. the unit will respond to the front panel controls). In order for the 4300B to enter the Remote mode the following sequence, stipulated by IEEE-488 1978, must occur:

1. The remote enable, REN, wire on the bus must be asserted (pulled low).

2. The 4300B must receive its listen address.

Using HP Basic this is accomplished by the statement **REMOTE 712**, assuming that the 4300B address is 12.

When the 4300B is in remote, the REMOTE IEEE-488 indicator on the front panel will be illuminated and all front panel controls (except POWER) are inhibited.

The computer may reset the 4300B to the local state at any time by the command **LOCAL 7** (or LOCAL 712 if only the 4300B is to be returned to the LOCAL mode). Note also that a device clear command will return the unit to local control.

A complete description of the workings of the IEEE interface is beyond the scope of this manual. The user should refer to the IEEE-488 standard for more details.

5-7. Simple Commands and Examples

This section gives examples using the codes shown in Table 5-2. In all examples the 4300B is assumed to be at address 12, and the language is assumed to be HP Basic. If you are using a language other than HP Basic, consult your programming manual for the correct command syntax.

Example #1: **OUTPUT 712;"V2,I3,C1"** will select the 2 Volt and 100mA ranges, and turn on the test current. The use of a comma between codes is not required but is recommended for clarity.

Example #2: **OUTPUT 712;"E"**
ENTER 712; A$

This will request the present configuration status of the 4300B. This *status word* will be contained in A$. See Table 5-2 for a dissection of the status word.

5-8. Return to Local

As mentioned previously, the controller may return the unit to local by the normal IEEE local commands. To ensure full compatibility with computers that do not have this capability the command "L" will also return the unit to local.

Example: **OUTPUT 712; "L"**

5-9. SRQ's and Serial Polls

SRQ Definition--The 4300B may assert the SRQ wire if it receives an undecipherable command. This is enabled by the user sending "Q_n", where n is the numeric code for the desired response.

Q0 - Disables the 4300B from asserting SRQ

Q1 - Enables the 4300B to assert SRQ if it receives an undecipherable command.

Serial Poll Response Byte - When the controller in the system conducts a serial poll, the 4300B responds with a non-zero byte of data. If the 4300B did not generate SRQ, a zero byte is used as the response.

5-10. Setting the IEEE Address

The IEEE "address" is the method by which the system controller distinguishes one device on the bus from another. The address of the 4300B is determined by the setting of a binary-weighted switch on the rear of the instrument. An example of setting the switches to address "12" is shown below:

	1	2	4	8	16
Off	‖	‖	‖	‖	‖
On			▼	▼	

In this case, **8 + 4 = 12**. In another example, the **16 + 8 + 1** switches would be enabled to set the address to 25.

The address you choose is entirely dependant on your application and by the type and quantity of devices on your IEEE bus. Some guidelines to follow are:

1) Each device on the bus must have its own unique address. Operating two devices at the same address will produce undefined results and is not recommended.

2) Avoid setting the 4300B to address 0 (all switches off) or to address 31 (all switches on) as this may interfere with the system controller.

3) If the setting of the switches is changed, power must be cycled in order to place the new address into memory.

5-11. Reading the Display

The 4300B display may be read by the system controller at any time at the rate of 2½ readings per second (12½ readings per second for 4350ATE). The 4300B does *not* need to be in REMOTE for the display to be read.

Example #1. Assume that the 4300B is in the 2V and .1mA ranges, and that its address is set at 12. The front panel display indicates "10567", which is 10,567 ohms. The commands below are executed:

```
ENTER 712;A$
PRINT A$
```

The 4300B responds with the following number (contained in A$): +1.0567E+4

This is the measurement in scientific notation, in ohms. The "E" signifies a power of 10^E.

Example #2. Assume the 4300B is in the 20mV and 10A ranges, and that its address is set at 25. The front panel display indicates "1.9095", which is equal to 1.9095 milliohms. The commands below are executed:

```
ENTER 725;A$
PRINT A$
```

The 4300B responds with the following number (contained in A$): +1.9095E-3

This is the measurement in scientific notation, in ohms. The "E" signifies a power of 10^E.

☞An over-range condition is indicated by:

+2.0000E±?

6-1. General

Option "BCD" provides parallel Binary Coded Decimal data output that corresponds to the display indication. Signals are also provided for range information, overload, and end of conversion (EOC). A run/hold line is also provided to halt the 4300B A-to-D converter (voltmeter). Also refer to drawings 4300-079 and 4300-609. The signals are TTL compatible ($0 \leq .8V$, and $1 \geq 2.4V$) and will drive 1 LS TTL load.

6-2. BCD Pin Assignments

Pins 1 to 17 - DATA

This is the BCD coded data which is identical to that being displayed by the 4300B.

Pin 18 - OVERLOAD

This is a logic 1 when the data on the lines above is an overload indication. (Note: The Data is arbitrary during this condition.)

Pins 19 to 21 - RANGE

This is a BCD exponent which indicates the present resistance range as follows:

1.9999×10^{R} milli-ohms.

	Pin #:			
Range	19	20	21	R
20000 Ω	1	1	1	7
2000 Ω	0	1	1	6
200Ω	1	0	1	5
20Ω/20000mΩ	0	0	1	4
2Ω/2000mΩ	1	1	0	3
200mΩ	0	1	0	2
20mΩ	1	0	0	1
2mΩ	0	0	0	0

Where:
$1 \geq 2.4V$
$0 \leq 0.8V$

Pin 22 - END OF CONVERSION (EOC)

A logic 1 signal indicates that a measurement is in progress. Note that the Data (pins 1 to 17) is not valid until 10 milliseconds after the high-to-low transition of this signal.

Pin 23 - RUN/HOLD

A logic 1 (or open circuit) on this pin enables the unit to perform continuous measurements. When this line is taken low, the unit completes the measurement in progress and halts. A pulse of 300nS will initiate a further measurement.

Pin 24 - 0 VOLTS

All signals are referenced to this pin. If it is inconvenient to use this pin as the common, the V_{LO} terminal may be used instead.

The mating connector for the BCD option is a 24-pin Male Amphenol 57 series connector, Valhalla Stock #05-10248. When using these outputs with a Valhalla Model 1248 Dual-Limit Comparator, use the IDC-3 cable for making connections.

The BCD connector pin functions are summarized in Table 6-1.

Table 6-1. BCD Pin Functions

Pin #	Function
1	1
2	2
3	4
4	8
5	10
6	20
7	40
8	80
9	100
10	200
11	400
12	800
13	1000
14	2000
15	4000
16	8000
17	10000
18	OVERLOAD
19	Range (1)
20	Range (2)
21	Range (4)
22	End of Conversion
23	Run/Hold
24	Common (0 volts)

SECTION VII THEORY OF OPERATION

7-1. General

The information contained in this section describes the theory of operation behind the Valhalla Model 4300B Digital Micro-Ohmmeter. The theory is divided into two sections. the first is a general description referring to the block diagrams of Figures 7-1 and 7-2. The second section is a detailed description referring to the schematics and diagrams at the back of this manual.

7-2. General Description of Circuits

This section describes the general function of each section of the Model 4300B. The paragraph titles used in this section refer to the block diagrams of Figures 7-1 and 7-2. "T" designates Figure 7-1 and "V" designates Figure 7-2.

7-2-1. Reference (I)

The current source reference voltage is provided by an internally ovened zener reference and its associated components. The reference circuit provides a 1.0000 volt output to the error amplifier circuit.

7-2-2. Error Amplifier (I)

The error amplifier compares the reference voltage with the signal from the range switching circuit to drive the output stage. The ON/OFF signal from the control logic commands the error amplifier to turn on or off the output stage.

7-2-3. Output Stage

The output stage provides current gain capable of driving +10 amps into the unknown resistance. The ON/OFF signal from the control logic disables the current source output when the test current is turned off.

7-2-4. Range Switching (I)

The range switching circuits provide six ranges of precision current shunts to control the output current. The current shunt values are selected so that 1 volt is dropped across the shunt for each current range (e.g. 10A in, 1V out; 1A in, 1V out; etc.). The operation of the current source is as follows: Current from the power supply flows through the load, output stage and current shunt. The voltage dropped across the shunt is compared to the reference voltage by the error amplifier. The error amplifier uses the voltage drop across the internal shunt to control the amount of current passing through the load as necessary to maintain a precise constant current.

7-2-5. Protection Circuitry (I)

The protection circuitry protects the output stage from inductive kickback voltages. The UNSAFE signal indicates the presence of back EMF from the load. See 4-5. A Metal Oxide Varistor (MOV) at the voltage input terminals protects the A to D converter by clamping any voltage in excess of 35V.

7-2-6. Power Supply (I)

The power supply provides the two available operating voltages for the current source. The output voltage is controlled by the comparator which automatically raises the compliance voltage when charging large inductors.

7-2-7. Comparator (I)

The comparator is used to detect if the error amplifier is against its end stop, indicating that the current source is charging an inductor. When an inductor is being charged, the comparator commands the power supply to output a higher voltage to reduce the ohmmeter settling time.

7-2-8. A-D Converter/Clock (V)

The analog to digital converter (A-D) measures the voltage drop across the load and converts the value into multiplexed BCD data. The A-D converter is a dual slope type. The clock oscillator supplies the necessary timing signals for the A-D converter. The A-D converter range is controlled via the control logic.

7-2-9. Reference Generator (V)

The Reference Generator provides one of three reference voltages for the A-D converter. When the ATC mode is selected, the temperature sensor (Option "AL" or "CU") compensates the Reference Generator output. The Reference Generator is controlled via the Control Logic.

7-2-10. Liquid Crystal Display/Driver (V)

The LCD Driver demultiplexes the BCD data from the A-D converter and provides the necessary signal conditioning to drive the liquid crystal display. The decimal point position is controlled via the Control Logic.

7-2-11. Front Panel Controls (V)

The Control Logic provides an interface between the front panel controls, displays, and the range circuitry of the 4300B. The Control Logic disables the front panel controls when the Option "TL-488" is fitted and the Remote LED is illuminated.

7-2-12. Power Supply (V)

The power supply provides the necessary operating voltages required by the Control Logic, A-D converter, displays and indicators.

7-3. Detailed Circuit Descriptions

This section describes in detail the operation of the main circuits of the Model 4300B. The reference designators used in this section refer to the drawings included at the back of this manual.

7-3-1. Current Source

The operation of the Current Source is described in the following paragraphs. All components in this section can be found on Schematic 4300-072 Sheet 1.

7-3-1-1. Reference

IC103 along with resistors R116-R118 and RV101 form a temperature-stabilized voltage reference. IC103 is a precision 6.95 volt ovened zener diode. The zener current is limited by resistor R116. A voltage divider composed of R117, RV101 and R118 divide the zener voltage down to 1.0000 VDC. Capacitor C103 removes any noise riding on the reference output.

7-3-1-2. Error Amplifier

The error amplifier is composed of C102, IC101A, R104, R103, RLB-2 and TR103. IC101A provides high DC gain to drive transistor TR103 via resistors R104 and R103. C102 provides local AC feedback around IC101A for stability. TR103 provides base current to the output stage. Relay contact RLB-2 is closed when the test current is turned off which removes the gate drive to TR103.

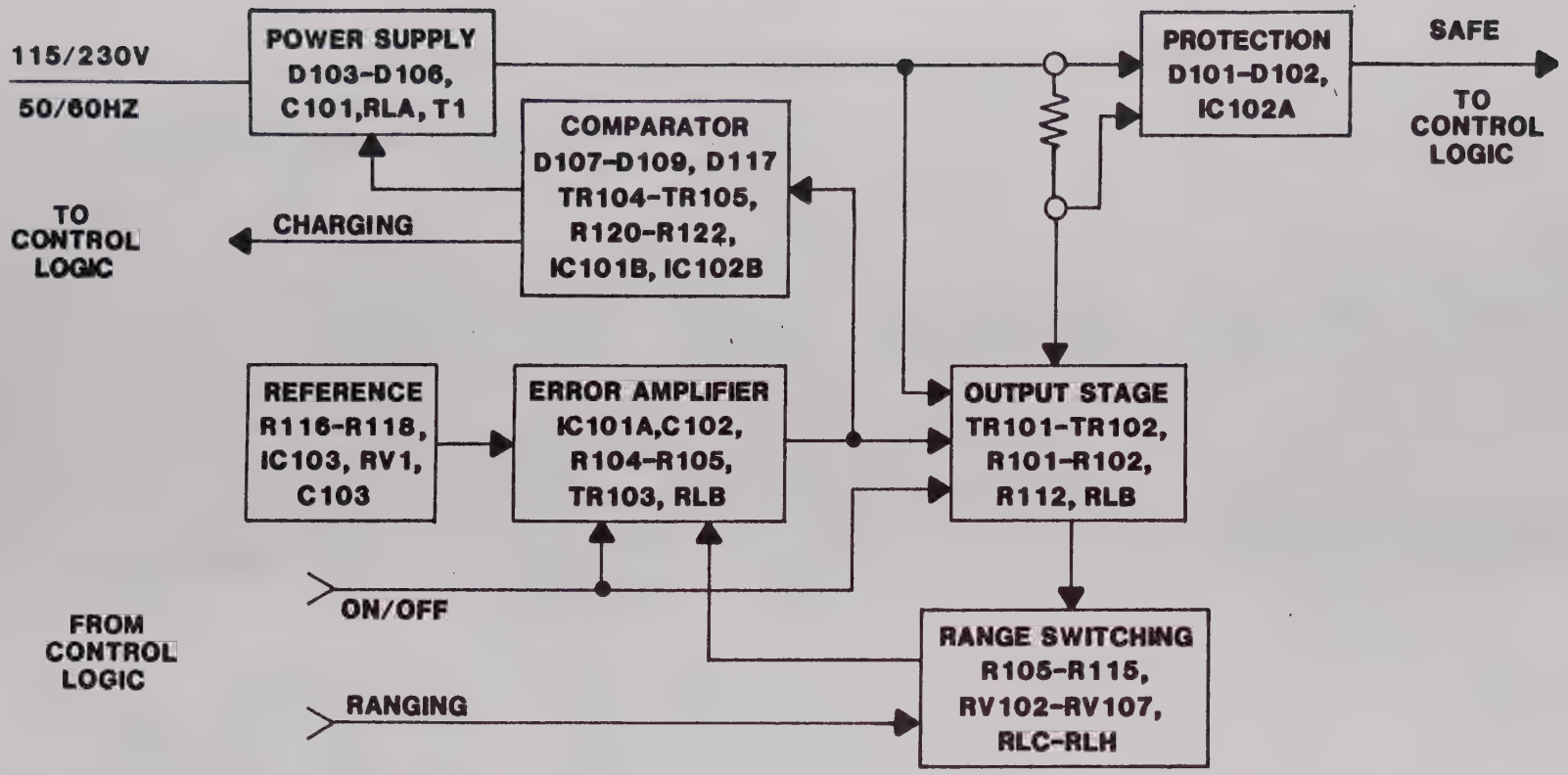


FIGURE 7.1 – 4300B CURRENT SOURCE BLOCK DIAGRAM

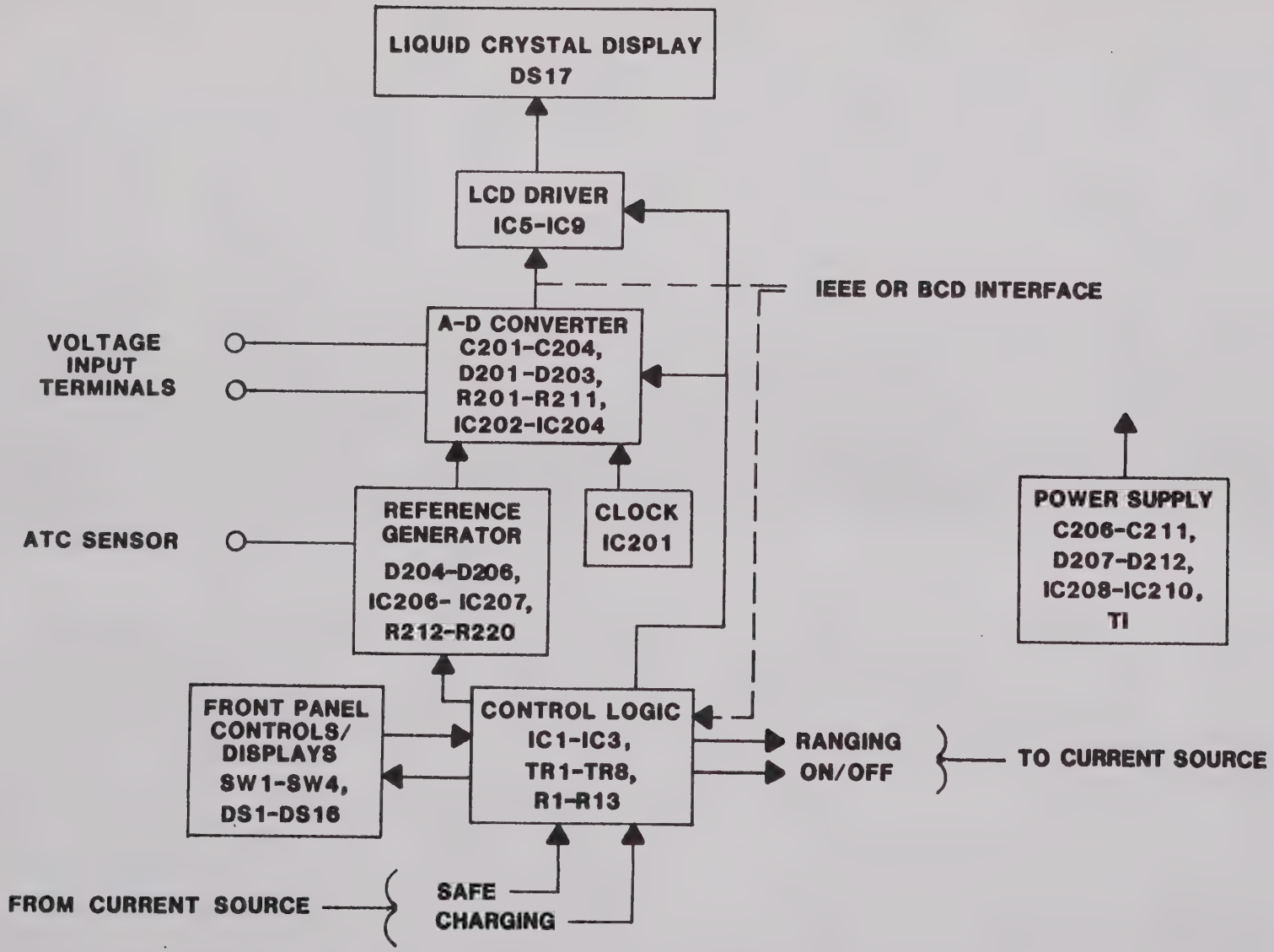


FIGURE 7.2 — 4300B VOLTMETER/LOGIC BLOCK DIAGRAM

7-3-1-3. Output Stage

The output stage, composed of TR101, TR102, R101, R102, R126 and RLB-1 provides current gain capable of sourcing 10 amps. Base drive for transistors TR101 and TR102 is provided by the error amplifier. Resistors R101 and R102 equalize the emitter currents in the two output devices. Relay contact RLB-1 is closed when the test current is turned off, which connects resistor R126 across the output terminals to reduce the output voltage to less than 20mV.

7-3-1-4. Range Switching

Range selection is accomplished by selecting one of the precision current shunts R105, R107, R109, R111, R113 or R115. Relays RLC thru RLH select the appropriate combination of shunts. Only one range relay is ever energized at any one time. Resistors R106, R108, R110, R112, and R114 along with potentiometers RV102 through RV105 are used to trim the shunts to produce a precise current output.

7-3-1-5. Protection Circuitry

The protection circuitry is composed of diodes D101, D102, opto-isolator IC102-A, R123 and R124. The two diodes provide a discharge path for inductive loads. D102 conducts when the back EMF from the load is greater than 5 volts which turns on the opto-coupler through R123 and R124. This circuitry is used to determine the Disconnect Status LED condition. A Metal Oxide Varistor (MOV) installed across the voltage input terminals is used to protect the A-D converter by clamping voltages that exceed 35 volts.

7-3-1-6. Power Supply

Relay RLA selects which secondary tap of transformer T1 is applied to the bridge rectifier composed of diodes D103-D106. Capacitor C101 smoothes the rectified AC voltage. Relay RLA is controlled by the comparator circuit to provide a higher voltage to the output stage to reduce settling time when an inductive load is being charged.

7-3-1-7. Charging Inductor Mode

The gate voltage of TR103 is compared to a reference voltage defined by D107-D109. When the gate voltage exceeds the reference voltage, TR105 conducts which energizes relay RLA and opto-coupler IC102-B. Transistors TR104 and TR105 form a Schmidt trigger circuit to reduce relay chattering. Buffer IC101-B isolates the gate drive circuit from the comparator to reduce rail injected noise.

7-3-2. Voltmeter/Control Logic

The operation of the voltmeter and control logic is described in the following paragraphs. Component references in this section can be found on Schematic 4300-072 Sheet 2.

7-3-2-1. A-D Converter/Clock

Most of the A-D converter circuitry is contained in IC's 202 and 203 along with their associated components. IC202 contains the digital section of a 4½ digit dual slope A-D converter; the analog section is contained in IC203.

The operating cycle of the dual slope integrating A-D converter is divided into three phases, whose duration is set by an external clock. The clock is provided by IC201, a self contained 100KHz CMOS crystal controlled oscillator.

During the first, or Auto Zero phase, the A-D input is internally shorted to analog ground and C203 is charged to the integrator's output offset voltage.

During the next two phases, the capacitor voltage subtracts from the analog input to cancel the offset.

During the second, or input integrate phase, the input voltage is connected to the integrator via the buffer composed of IC204 and associated components. IC203 integrates the input for a precise time (10,000 counts of the clock) by charging C204 linearly towards the input voltage. The buffer gain is controlled by analog switch IC207 and relay RLK. The gain of the buffer along with the reference voltage determines the A-D converter's full scale range. The A-D converter's full scale voltages are tabulated in Table 7-1. The gain is determined by the position of the voltage range selector on the 4300B front panel.

Table 7-1. A-D Converter Buffer Gains

Voltage Range	Reference Voltage (pin 7 of IC202)	(IC204) Buffer Gain	Full Scale Input Voltage
20mV	10mV	100	19.999mV
200mV	100mV	10	199.99mV
2V	1V	1	1.9999V

The waveform on C204 is a very linear ramp whose slope is proportional to the input voltage. Thus, the charge on C204 at the end of the integrate phase is also proportional to the input voltage. During the third or reference integrate phase, a fixed reference voltage of polarity opposite the input voltage is applied to the integrator. IC203 begins discharging C203 toward the reference voltage.

Because this voltage is fixed, the discharge slope is constant. Therefore, the time required to discharge C203 back to zero is proportional to the input voltage. This time is measured by an internal counter in IC202. These counts are latched in a multiplexer, also internal to IC202, at the end of the count period. The result is a multiplexed BCD output proportional to the input voltage. The full scale voltage input to the A-D converter is dependent on the buffer gain and also on the reference voltage.

7-3-2-2. Reference Generator

The reference generator provides one of three voltages to the A-D converter to determine its sensitivity. IC205 is an oven stabilized zener diode providing a 6.95 volt nominal output to the voltage divider composed of R212, R213, RV202 and R214. R214 is replaced with the temperature compensator when using Options "CU" and "AL" in the ATC mode.

The output of the voltage divider is amplified by IC206 and associated components. Variable resistor RV203 allows adjustment of the amplifier gain to establish a 1.0000 volt reference. The 1.0000 volt reference is applied to the voltage divider composed of R218-R220, RV204 and RV205. The voltage divider provides 100.00mV and 10.000mV outputs.

Analog switch IC207 selects which reference voltage is applied to the A-D converter per Table 7-1. If the ATC compensator connector is open-circuited and ATC mode is selected the output of IC206 goes to the positive rail. If this happens, the FAULT LED is triggered through D204. Diode D204 provides level shifting to produce a TTL compatible signal to the control logic.

7-3-3. Display Board

The following paragraphs detail the operation of the 4300B display board. All component references can be found on Schematic 4300-073 Sheets 1 and 2.

7-3-3-1. Liquid Crystal Display

Most of the LCD driver circuitry is contained in IC7. IC7 decodes the multiplexed BCD and provides proper signal levels necessary to drive the LCD. The multiplexed BCD from the A-D converter is buffered before going to IC7 via IC's 8 and 9.

The four least significant digit lines are qualified by the Strobe signal from the A-D converter. The lines are overranged by the Overrange signal from the A-D converter. When an overrange occurs, the digit lines go to a high state. The display driver blanks the display for this input code. IC6 provides level shifting to drive the polarity sign and the "1" digit. The decimal points are driven via exclusive-or gate IC5.

7-3-3-2. Front Panel Controls

The front panel controls utilize negative-true TTL logic levels, with "0" being the asserted state. The front panel controls are enabled via transistor TR1. The option "TL-488" PCB pulls the REM line low to disable the front panel controls when operating remotely via the bus (see Section 5).

LED DS2 is illuminated when the REM line is low, indicating remote operation. The front panel controls are diode ranged with the outputs of the "TL-488" PCB to allow remote operation.

The voltage and current ranges are determined by IC2 and IC3. IC3 is a BCD-to-decimal converter which decodes the current range switch and provides a one-of-six active-low output that drives LED's DS8-DS13 and the current source range relays.

The current and voltage range switch information also goes to the PROM, IC2. The PROM provides three outputs to drive the voltage range LED's DS14-DS16 and the A-D converter reference selector IC207 (See Section 7-3-2-2). The PROM decodes the voltage and current range information to enable the four decimal point lines to the LCD driver circuitry. Another output from the PROM triggers the cable disconnect status logic and is composed of TR3, TR6-TR8 and their associated components. This logic determines that it is unsafe to disconnect the cables when:(a)the Test Current is On and 100mA or greater current is selected or (b)the back EMF from a load is greater than five volts (See Section 7-3-1-5).

The Charging Inductor LED is driven by the CHG signal via transistor TR4. The Test Current On LED is driven by TR2 and its associated components. TR6 drives the current source Test Current Off relay, RLB.

The ATC ON LED and ATC relay (RLJ) in the reference generator are driven by TR5 (See Section 7-3-2-2).

7-3-3-3. Power Supplies

Power for the voltmeter and control logic circuits is provided by two windings of transformer T1. The AC voltages are rectified by diodes D207-D212. See Schematic 4300-072 Sheet 2.

These raw DC voltage levels are regulated by IC's 208 to 211 to produce +5V, +15V, -15V, and +12V respectively. IC211 is mounted on the rear panel and provides the +12VDC necessary to power the cooling fan.

7-4. Troubleshooting

Apparent malfunctions are often the result of misinterpretation of specifications or due to an incomplete understanding of the instrument. **A thorough review of the operating instructions for this instrument is recommended prior to any component replacement, etc.** Check to be sure that cables and other test equipment are in good working order before attempting to troubleshoot the 4300B.

If the Model 4300B exhibits problems that cannot be eliminated by reviewing Sections 2, 4, 5, 7, or 9, the following guidelines have been established to help solve the problem.

7-4-1. Localizing the Problem

The key to successful troubleshooting is to localize the problem as much as possible before trying to pin the problem down to a specific component. Certain questions should be asked such as "Does the problem occur on all ranges or on a specific range only?". The power supplies are also one of the first things that should be checked.

As it is not possible to anticipate all failure modes of the 4300B, servicing personnel should become familiar with Section 7 to gain a complete understanding of the internal workings of this instrument.

7-4-2. Component Replacement

If the problem has been identified as a faulty component, the accuracy of the 4300B can be maintained only if the following precautions are taken:

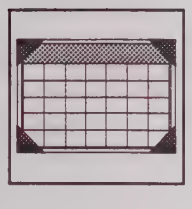
- Use only the specified component or its exact equivalent. Spare parts can be ordered from your nearest Valhalla Scientific Service Center or from the factory directly by referring to the Valhalla Stock Number listed in the Parts Lists section at the back of this manual.

- Use only 63/37 grade rosin core electronic grade solder with a 50W or lower maximum power soldering iron.

- When soldering, heat the terminal of the component, *not* the solder. Apply solder smoothly and evenly. Do not move the component until the solder has cooled. **Bad solder joints can cause additional problems!**

- Static sensitive parts require special handling procedures. Always treat an unknown part as if it were static sensitive.

SECTION VIII CALIBRATION PROCEDURE



8-1. General

This section provides general maintenance information and a procedure for calibrating the 4300B. The 4300B Digital Micro-ohmmeter should be calibrated on a routine basis (annually is recommended) to ensure continued accuracy. The 4300B should also be regularly dusted using dry, compressed air to remove any debris.

Before performing the calibration procedure below, the 4300B should be warmed up for at least 30 minutes with the top cover in place. The top cover should be replaced after each adjustment has been made. Allow time for the unit to restabilize after making each adjustment.

8-2. Required Test Equipment

The following test equipment is required to calibrate the 4300B Digital Micro-Ohmmeter.

1) DC Voltage Standard with available outputs of 1.0000V, .1000V, .010000V ±.005% (Valhalla 2701C or equivalent)

2) Precision Resistors

   0.1000Ω
   1.0000Ω (with known
   10.000Ω values to within
   100.00Ω ±0.005%)
   1000.0Ω
   10000Ω

3) Heavy duty cables capable of carrying 10 Amps minimum.

8-3. Voltmeter Calibration

The following procedure describes calibration of the voltmeter section of the 4300B. In all steps the Test Current should be turned Off, and the .1mA Current Range selected.

8-3-1. Zero Adjustment

Select the 20mV range and apply +0.00001VDC. Adjust RV201 for a reading of 00.10. (±5 digits drift maximum)

8-3-2. ATC Balance Adjustment

This adjustment should be performed only if components have been replaced and need not be performed on a routine basis.

Select the 2V range. Apply 1.0000VDC to the input terminals and connect a precision 1.00K .05% resistor to the ATC connector. Alternately select and deselect the ATC mode. Adjust RV202 for minimum shift in readings between normal and ATC modes.

8-3-3. 2 Volt Range Adjustment

Select the 2V range and apply +1.0000 volts to the voltage input terminals. Adjust RV203 for a reading of 10000.

8-3-4. 200mV Range Adjustment

Select the 200mV range and apply +.10000 volts to the voltage input terminals. Adjust RV204 for a reading of 1000.0.

8-3-5. 20mV Range Adjustment

Select the 20mV range and apply +10.000mV to the voltage input terminals. Adjust RV205 for a reading of 100.00.

8-4. Current Source Calibration

The following procedure should be performed when calibrating the current source section of the 4300B. In all steps the current source is calibrated to the internal voltmeter therefore the voltmeter calibration of Section 8-3 should be performed before proceding. Alternately, an external voltmeter of greater than ±0.005% accuracy may be used.

8-4-1. Reference Adjustment

This adjustment should only be performed if components in the reference section have been replaced and need not be performed on a routine basis. A DC voltmeter with a minimum of ±0.03% accuracy is needed to make the adjustment.

Connect the voltmeter low lead to 0V (front of R118) and the voltmeter high lead to IC101 pin 5. Adjust RV101 for 1.0000 volts. Remove the voltmeter leads.

8-4-2. 10 Amp Adjustment

Connect the .1 ohm standard resistor to the 4300B using four-wire connections. Select the 2V and 10A ranges on the 4300B. Adjust RV102 for a reading of 100.00mΩ. Allow extra time for settling in this range. Keep the cover on as much as possible to ensure proper cooling of components.

8-4-3. 1 Amp Adjustment

Connect the 1 ohm standard resistor to the 4300B using four-wire connections. Select the 2V and 1A ranges. Adjust RV103 for a reading of 1000.0mΩ.

8-4-4. 0.1 Amp Adjustment

Connect the 10 ohm standard resistor to the 4300B using four-wire connections. Select the 2V and .1A ranges. Adjust RV104 for a reading of 10000mΩ.

8-4-5. 10mA Adjustment

Connect the 100 ohm standard resistor to the 4300B using four-wire connections. Select the 2V and 10mA ranges. Adjust RV105 for a reading of 100.00Ω.

8-4-6. 1mA Adjustment

Connect the 1000 ohm standard resistor to the 4300B using four-wire connections. Select the 2V and 1mA ranges. Adjust RV106 for a reading of 1000.0Ω.

8-4-7. 0.1mA Adjustment

Connect the 10000 ohm standard resistor to the 4300B using four-wire connections. Select the 2V and .1mA ranges. Adjust RV107 for a reading of 10000Ω.

9-1. General

This section contains a number of useful tips that should be noted when working with inductive loads. Inductive loads include devices such as transformers, coils, ballasts, wire-wound resistors, magnets and motors. These types of devices require special consideration as described below.

9-2. Connections and Settling Time

When connecting the cables to the inductive load, care should be taken not to draw an arc. The Test Current should be turned Off and the cables positively clamped onto the load before applying current.

When measuring highly inductive loads the settling time of the ohmmeter is determined by the compliance voltage of the current source. Typically, the compliance voltage of a 4300B in the Charging Inductor mode is in excess of 20 volts. Thus, with an inductor of 1000 Henries (an extremely large transformer) the unit will take approximately 10 minutes to settle. During settling, the unit will display overload and should be ignored until the Charging Inductor indicator is extinguished.

The actual equation for determining settling time is as follows:

$$T = (L \times I)/V$$

Where:

T = settling time in seconds
L = inductance in Henries
I = current range (in amps)
V = compliance voltage of 4300B (20V)

Note that the higher the test current, the longer the settling time.

9-3. Noisy Readings

When measuring very low resistances of highly inductive loads, care should be taken to reduce 60Hz pickup at the input to the 4300B. The noise pickup is caused by the very high impedance of the load at 60Hz given by the formula:

$$Z = 377 \times L$$

Where:

Z = Impedance in ohms
L = Inductance in Henries

Thus, with a 1000 Henry transformer the impedance at 60Hz would be 377Kohm, across which many millivolts of noise may be induced by movement or by interference from other devices.

This effect may be reduced by using fully shielded cables such as Valhalla Option "K". It may also be helpful (and will cause the settling time to be reduced) if the unused windings of the transformer can be short-circuited during the measurement. This will significantly reduce the inductance of the winding under test, and will also prevent the unused windings from producing dangerous voltages during charging and discharging of the transformer.

When using the 20mV voltage range, the measurement may be subject to the effects of thermal EMF's. This effect is seen as noise on the display. The best way to reduce this effect is to use a low-thermal lead set such as Valhalla Option SL-48.

9-4. Disconnecting the Cables

When disconnecting the test leads from the load or from the 4300B, extreme care must be taken to ensure that the inductor has been discharged to prevent an extremely high energy, high voltage "kick-back" which can be **LETHAL** to the user and can certainly damage the 4300B. There are two methods of discharging the energy in the inductor listed below.

a) Using the "Flyback Diode" in the 4300B.

As discussed in Section 7-3-1-5, the 4300B has an internal diode which can sink the excess current being discharged from the inductor. Therefore turning off the test current and/or reducing the 4300B's current range from the original test current to a low value (less than 10mA) will automatically discharge the inductor into the Flyback diode. **The cables should not be disconnected until the SAFE cable disconnect status LED is illuminated.**

The time required to discharge the inductor into the Flyback diode is given by the formula:

$$T = (L \times I)/V$$

T	=	Discharge time in seconds
L	=	Inductance in Henries
I	=	Current range (in Amps)
V	=	Flyback Diode voltage drop (typically 6 volts)

For example, a 1000 Henry inductor will take approximately 30 minutes to discharge. During discharge the 4300B display will read overload until the inductor has completely discharged. The reading will then return close to zero.

b) Using a Shorting Switch

When using a shorting switch instead of the 4300B flyback diode, the current stored in the inductor discharges through the cables and switch. This current discharges with a time constant calculated from the formula below which is dependant on the test current that was used to charge the inductor:

Test Current Range Used:	Discharge Time (in Seconds):
10 Amps	7 x L ÷ R
1 Amp	5 x L ÷ R
.1 Amp	2 x L ÷ R
< .1 Amp	Not required

Where:

L = Inductance in Henries
R = Total resistance of cables, switch and inductor (in ohms)

In a typical application R might be approximately 1 milliohm (.001Ω) and L might be 1000 Henries. If the 10 amp range of the 4300B was used to measure the inductor, 7,000,000 seconds are required (11½ weeks) to discharge it. The 4300B may be disconnected at any time provided the short circuit is maintained across the winding.

SECTION X MANUAL CHANGES

Immediately following this page may be found any notices regarding Operation Manual changes, or operating considerations for special variations of the ohmmeter. Please refer to any applicable material before attempting to operate your Micro-Ohmmeter.

Addendum 10-1 4350ATE Specifications

ADDENDUM 10-1: 4350ATE Specifications

The Valhalla Model 4350ATE High-Speed Digital Micro-ohmmeter is a variation of the Model 4300B ohmmeter. The 4350ATE has been specially designed for use on assembly lines to make high speed resistance measurements. The 4350ATE is designed to be controlled by a computer, however it may also be used via the front panel display by heeding several restrictions which are listed below.

The operating principles of the 4350ATE are very similar to the 4300B, and most points discussed in this manual apply to both instruments. The 4350ATE may be used manually (see Section 4) in all ranges with the following exceptions: **20mV/.1mA, 20mV/1mA, and 200mV/.1mA.** The use of these ranges is restricted to remote operation due to noise characteristics. Remote operation is described in Section 5. (Also see Programmer's Notes below.)

Programmer's Notes:

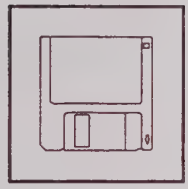
1) The conversion rate of the 4350ATE is increased to 80ms.

2) Due to the high speed of the 4350ATE, resistance readings must be averaged when using the following combinations of voltage and current ranges:

Range	Minimum
20mV/.1mA	5 conversions
20mV/1mA	3 conversions
20mV/10mA	2 conversions
200mV/.1mA	5 conversions
200mV/1mA	3 conversions
2V/.1mA	3 conversions
2V/1mA	2 conversions

3) All other commands, functions and precautions remain the same.

SECTION XI PARTS LISTS



The following parts lists are included in this manual:

4300-602	3 pages	4300B Main Board Assembly
4300-605	1 page	4300B Output Board Assembly
4300-603	2 pages	4300B Display Board Assembly
4300-604	1 page	4300B Switch Board Assembly
4300-401	2 pages	4300B Chassis Assembly
4300-402	1 page	4300B Rear Panel Assembly
4300-403	2 pages	4300B Option TL-488 Assembly
4300-407	1 page	4300B Option JB-2 Assembly
4300-609	1 page	4300B Option BCD Assembly

REF.DES.	STOCK #	QUANTITY A	QUANTITY T	QUANTITY N	DESCRIPTION	MANUFACTURING/PURCHASING DATA
86	05-10211	3			Heatsink, TO220	Thermalloy 6106B-14
91	90-04006	3			#4-40 x 3/8" Phil Pan S.S.	
92	90-06005	2			#6-32 x 5/16" Phil Pan S.S.	
93	97-04001	3			#4-40 Radio Hex Nut S.S.	
94	97-06001	2			#6-32 Hex Nut, SMALL PATTERN, S.S.	
96	98-06002	4			#6 Internal Star Washer, S.S.	
97	98-04001	3			#4 Split Lock Washer S.S.	
98	80-00022	2			22awg Bus Wire	1BB-2201 ANIXTER
99	80-00012	6			12awg Bus Wire, Solid Tinned Copper	MANHATTAN M977
100	70-11022	3			22awg TFE Sleeving	ATC TFT 22
101	05-10449	1			Cable tie, 14"x.15"	Panduit PLT41-M
102	05-10266	1			Strip,rubber,adhesive,neoprene,3/16T,1/2W	ACC. Rubber 1/2x3/16-NEOPRENE
103	70-00001	8			1/16" Black Shrink Tubing	M23053-5-102-0
A1	04-30109	1			4300B Main Board	DWG 4300-702
C102	02-60002	1			0.1u 250V Mylar	Illinois 104MSR250K
C103	02-30001	1			10uF 25V Tantalum Bead	AVX TAP106K025SP
C104	02-60017	1			0.1uF,63V,Mylar,5%	WIMA MKC2-0.1uF
C201	02-90006	1			1u 5% 50V Polycarbonate	IMB RA20105J
C202	02-90003	1			5u 5% 50V Polycarbonate	IMB RA7A505J
C203	02-90006	1			1u 5% 50V Polycarbonate	IMB RA20105J
C204	02-50000	1			0.22u 10% 50V Polystyrene	F-Dyne FSA 0.22uF 10% or Equiv.
C205	02-30001	1			10uF 25V Tantalum Bead	AVX TAP106K025SP
C206	02-40054	1			2200 20% 25V Aluminum	Illinois 228TTA025
C207	02-30001	1			10uF 25V Tantalum Bead	AVX TAP106K025SP
C208	02-40013	1			470uF 50V Aluminum	Illinois 477TTA050
C209	02-30001	1			10uF 25V Tantalum Bead	AVX TAP106K025SP
C210	02-40013	1			470uF 50V Aluminum	Illinois 477TTA050
C211	02-30001	1			10uF 25V Tantalum Bead	AVX TAP106K025SP
C212	02-30001	1			10uF 25V Tantalum Bead	AVX TAP106K025SP
D103	03-20011	1			Diode, rectifier, 10A,(DO-5)	1N1183A
D104	03-20011	1			Diode, rectifier, 10A,(DO-5)	1N1183A
D105	03-20012	1			Diode, rectifier, 10A (reverse),(DO-5)	1N1183RA
D106	03-20012	1			Diode, rectifier, 10A (reverse),(DO-5)	1N1183RA
D107	03-20000	1			Diode, general purpose	1N4148 or 1N914
D108	03-20000	1			Diode, general purpose	1N4148 or 1N914
D109	03-20000	1			Diode, general purpose	1N4148 or 1N914
D110	03-20000	1			Diode, general purpose	1N4148 or 1N914
D111	03-20000	1			Diode, general purpose	1N4148 or 1N914
D112	03-20000	1			Diode, general purpose	1N4148 or 1N914
D113	03-20000	1			Diode, general purpose	1N4148 or 1N914
D114	03-20000	1			Diode, general purpose	1N4148 or 1N914
D115	03-20000	1			Diode, general purpose	1N4148 or 1N914
D116	03-20000	1			Diode, general purpose	1N4148 or 1N914
D117	03-20005	1			Diode, Zener, 6.2V, 10%	1N5234
D118	03-20040	1			Diode, zener, 30V, 10%	Motorola 1N5256
D120	03-20000	1			Diode, general purpose	1N4148 or 1N914
D201	03-20000	1			Diode, general purpose	1N4148 or 1N914
D202	03-20000	1			Diode, general purpose	1N4148 or 1N914
D203	03-20000	1			Diode, general purpose	1N4148 or 1N914
D204	03-20017	1			Diode, zener, 9.1V, 10%	1N5239

REF.DES.	STOCK #	QUANTITY A	QUANTITY T	QUANTITY N	DESCRIPTION	MANUFACTURING/PURCHASING DATA
D205	03-20000	1			Diode, general purpose	1N4148 or 1N914
D206	03-20000	1			Diode, general purpose	1N4148 or 1N914
D207	03-20002	1			Diode, rectifier, 1A, 50V	1N4001-1N4007
D208	03-20002	1			Diode, rectifier, 1A, 50V	1N4001-1N4007
D209	03-20002	1			Diode, rectifier, 1A, 50V	1N4001-1N4007
D210	03-20002	1			Diode, rectifier, 1A, 50V	1N4001-1N4007
D211	03-20002	1			Diode, rectifier, 1A, 50V	1N4001-1N4007
D212	03-20002	1			Diode, rectifier, 1A, 50V	1N4001-1N4007
IC101	03-30326	1			Dual General Purpose Op Amp	LM358AN
IC102	03-30201	1			Dual general purpose opto-isolator	ILCT6 or MCT6
IC103	03-30122	1			6.95V 1% Precision reference	National or Lin. Tech. LM399H or AH
IC201	05-02007	1			Programmable Osc.,8.3Hz-1MHz	Statek,PX01000KHzA
IC202	03-30114		1		A to D convertor (digital portion)	Intersil ICL71C03ACPI or equiv.
IC203	03-30113		1		A to D Convertor (analog portion)	Intersil ICL8068ACPD or equiv.
IC204	03-30315	1			Precision JFET Op Amp	Burr Brown OPA103CM
IC205	03-30122	1			6.95V 1% Precision reference	National or Lin. Tech. LM399H or AH
IC206	03-30170	1			Low Noise, low drift Op-amp	OP07DP
IC207	03-30327	1			Quad CMOS Analog Switch	DG201ACJ
IC208	03-30034	1			Regulator,+5V,0.5A,TO202 or TO220	78M05CP or LM340T-5.0
IC209	03-30036	1			Regulator,+15V,0.5A,TO202 or TO220	78M15CP or LM340T-15
IC210	03-30037	1			Regulator,-15V,0.5A,TO202 or TO220	79M15CP or LM320T-15
PL1	05-10399	1			Cable 20pin Dil to 20pin Dil, 2.25 inches	DWG 4300-054
PL2	05-10399	1			Cable 20pin Dil to 20pin Dil, 2.25 inches	DWG 4300-054
PL3	05-10368	1			Wafer, 4 pin, gold, .56"	Molex 22-10-2041
PL5	05-10398	1			WAFER,2 PIN,GOLD,0.56",0.10 SPC.	Molex 22-10-2021
R103	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R104	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R105	01-20051	1			8.95K 0.1% 5ppm/C wire wound	Goldstar GS805-8K95-0.1%-5ppm
R106	01-10072	1			64.9K 1% 50ppm/C 1/4W Metal Film	RN60C6492F
R107	01-20050	1			909 0.1% 5ppm/C iwre wound	Goldstar GS809-909R-0.1%-5ppm
R108	01-10071	1			6.49K 1% 50ppm/C 1/4W Metal Film	RN60C6491F
R109	01-20049	1			90.9 0.1% 5ppm/C wire wound	Goldstar GS809-90R9-0.1%-5ppm
R110	01-10070	1			649 1% 50ppm/C 1/4W Metal Film	RN60C6490F
R111	01-20048	1			9.09 0.1% 5ppm/C wire wound	Goldstar GS811-9R09-0.1%-5ppm
R112	01-10069	1			64.9 1% 50ppm/C 1/4 Metal Film	RN60C64R9F
R113	01-20047	1			0.909 0.1% Manganin	Goldstar R0004 (Lollipop)
R114	01-10052	1			10 1% 50ppm/C 1/4W Metal Film	RN60C10R0F
R115	01-20123	1			0.101 0.1% Manganin	Goldstar R0008 (Pyramid)
R116	01-01045	1			2K 5% 1/4W Carbon Film	RC07GF202J
R117	01-20122	1			46.5K 0.05% 5ppm/C Wire Wound	Goldstar GS711-46K5-0.05%-5PPM
R118	01-20121	1			7.25K 0.05% 5ppm/C Wire Wound	Goldstar GS711-7K25-0.05%-5PPM
R120	01-01033	1			470 5% 1/4W Carbon Film	RC07GF471J
R121	01-01041	1			1K 5% 1/4W Carbon Film	RC07GF102J
R122	01-01043	1			1.5K 5% 1/4W Carbon Film	RC07GF152J
R123	01-10024	1			140 1% 50ppm/C 1/4W Metal Film	RN60C1400F
R124	01-01026	1			220 5% 1/4W Carbon Film	RC07GF221J
R125	01-01041	1			1K 5% 1/4W Carbon Film	RC07GF102J
R126	01-10085	1			249 1% 50ppm/C 1/4W Metal Film	RN60C2490F
R127	01-01033	1			470 5% 1/4W Carbon Film	RC07GF471J
R128	01-01041	1			1K 5% 1/4W Carbon Film	RC07GF102J
R129	01-10000		1		FACTORY SELECT VALUE	RN60CXXX

REF.DES.	STOCK #	QUANTITY A	QUANTITY T	QUANTITY N	DESCRIPTION	MANUFACTURING/PURCHASING DATA
R130	01-01041	1			1K 5% 1/4W Carbon Film	RC07GF102J
R201	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R204	01-01100	1			1M 5% 1/4W Carbon Film	RC07GF105J
R205	01-01007	1			10 5% 1/4W Carbon Film	RC07GF100J
R206	01-01070	1			33K 5% 1/4W Carbon Film	RC07GF333J
R207	01-01086	1			220K 5% 1/4W Carbon Film	RC07GF224J
R208	01-01041	1			1K 5% 1/4W Carbon Film	RC07GF102J
R209	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R210	01-01081	1			100K 5% 1/4W Carbon Film	RC07GF104J
R211	01-01081	1			100K 5% 1/4W Carbon Film	RC07GF104J
R212	01-01041	1			1K 5% 1/4W Carbon Film	RC07GF102J
R213	01-20024	1			59K 0.05% 5ppm/C Wire wound	Goldstar GS803-59K-.05%-5PPM
R214	01-20149	1			1K .05% 5ppm/C Wire Wound	Goldstar GS602-1K-.05%-5ppm
R215	01-20149	1			1K .05% 5ppm/C Wire Wound	Goldstar GS602-1K-.05%-5ppm
R216	01-20121	1			7.25K 0.05% 5ppm/C Wire Wound	Goldstar GS711-7K25-0.05%-5PPM
R217	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R218	01-20076	1			89.95K 0.05% 5ppm/C wire wound	Goldstar GS805-89K95-0.05%-5ppm
R219	01-20051	1			8.95K 0.1% 5ppm/C wire wound	Goldstar GS805-8K95-0.1%-5ppm
R220	01-20074	1			995 0.05% 5ppm/C wire wound	Goldstar GS805-995R-0.05%-5ppm
RV101	01-50012	1			10K Top Adjust	Beckman 68WR10K
RV102	01-50018	1			10 Top Adjust	Beckman 68WR10ohm
RV103	01-50014	1			100 Top Adjust	Beckman 68WR100ohm
RV104	01-50013	1			1K Top Adjust	Beckman 68WR1K
RV105	01-50012	1			10K Top Adjust	Beckman 68WR10K
RV106	01-50024	1			100K Top Adjust	Beckman 68WR100K
RV107	01-50014	1			100 Top Adjust	Beckman 68WR100ohm
RV201	01-50012	1			10K Top Adjust	Beckman 68WR10K
RV202	01-50018	1			10 Top Adjust	Beckman 68WR10ohm
RV203	01-50029	1			500 Top Adjust	Beckman 68WR500ohm
RV204	01-50014	1			100 Top Adjust	Beckman 68WR100ohm
RV205	01-50018	1			10 Top Adjust	Beckman 68WR10ohm
RLA	05-03092	1			Relay,Cradle,1C,10A,6V	Guardian,1345-1C-6VDC
RLB	05-03072	1			Relay,2PDT,5V,1500V breakdown	Aromat DS2E-M-DC5V
RLC	05-03012	1			Relay,Reed,5V Coil,DIL,Form A	Sigma,191TE1A1-5S
RLD	05-03012	1			Relay,Reed,5V Coil,DIL,Form A	Sigma,191TE1A1-5S
RLE	05-03012	1			Relay,Reed,5V Coil,DIL,Form A	Sigma,191TE1A1-5S
RLF	05-03012	1			Relay,Reed,5V Coil,DIL,Form A	Sigma,191TE1A1-5S
RLG	05-03072	1			Relay,2PDT,5V,1500V breakdown	Aromat DS2E-M-DC5V
RLH	05-03092	1			Relay,Cradle,1C,10A,6V	Guardian,1345-1C-6VDC
RLJ	05-03072	1			Relay,2PDT,5V,1500V breakdown	Aromat DS2E-M-DC5V
RLK	05-03012	1			Relay,Reed,5V Coil,DIL,Form A	Sigma,191TE1A1-5S
TR103	03-10036	1			Transistor VMOS (TO3)	IRF133
TR104	03-10010	1			PNP Transistor (TO92)	2N4402
TR105	03-10010	1			PNP Transistor (TO92)	2N4402
TR106	03-10000	1			N-Channel JFET	U1899E
TR107	03-10067	1			TMOS FET Transistor (TO-92)	Motorola 2N7000
XIC101	05-10824	1			Socket, DIL, 8Pin	Augat 208-AG49D
XIC202	05-10295	1			Socket, dil, 28 pin	Burndy DILB28P-108
XIC203	05-10041	1			Socket, dil, 14 pin	Burndy 8514-01

REF.DES.	STOCK #	QUANTITY A	QUANTITY T	QUANTITY N	DESCRIPTION	MANUFACTURING/PURCHASING DATA
6	98-10002	2			#10 Internal Star Washer	
8	97-10001	2			#10-32 Radio Hex Nut	
10	90-06009	4			#6-32 x 9/16" Phil Pan S.S.	
11	97-06001	4			#6-32 Hex Nut, SMALL PATTERN, S.S.	
12	98-06002	4			#6 Internal Star Washer, S.S.	
16	80-01120	1			20awg Wire, Brown PVC	M16878/1-BGE-1
17	80-01214	1			14awg Wire, Red PVC	M16878/1-BKE-2
18	80-01320	1			20awg Wire, Orange PVC	M16787/1-BGE-3
19	80-01514	1			14awg Wire, Green PVC	M16878/1-BKE-5
20	80-01420	1			20awg Wire, Yellow PVC	M16878/1-BGE-4
A1	04-30112	1			4300B Output Board	DWG 4300-705
D101	03-20012	1			Diode, rectifier, 10A (reverse),(DO-5)	1N1183RA
D102	03-20032	1			Diode, zener, 4.3V, 20%, 50watt	1N4550
HS1	04-10406	1			4300B Heat Sink	DWG 4300-220
R101	01-30003	1			0.1 5% 3W power wire wound	Ohmite 4330
R102	01-30003	1			0.1 5% 3W power wire wound	Ohmite 4330
TR101	03-10037	1			NPN Darlington (TO3)	2N6282
TR102	03-10037	1			NPN Darlington (TO3)	2N6282
XTR101	05-10232	1			Washer, insulator, TO3	Berquist K4-06
XTR102	05-10232	1			Washer, insulator, TO3	Berquist K4-06

REF.DES.	STOCK #	QUANTITY A	QUANTITY T	QUANTITY N	DESCRIPTION	MANUFACTURING/PURCHASING DATA
40	70-00003	5			3/16" Black Shrink Tubing	3000187 BLK 3M
A1	04-30110	1			4300B Display Board	DWG 4300-703
C1	02-20021	1			27p 500V Mica	CM05FD270J03
C2	02-30001	1			10u 25V Tantalum Bead	AVX TAP106K025SP
C3	02-60002	1			0.1u 250V Mylar	Illinois 104MSR250K
D1	05-01005	1			Single LED,Red,Small	Hewlett Packard,HLMP1000
D2	03-20000	1			Diode, general purpose	1N4148 or 1N914
D3	03-20000	1			Diode, general purpose	1N4148 or 1N914
D4	03-20000	1			Diode, general purpose	1N4148 or 1N914
D6	03-20000	1			Diode, general purpose	1N4148 or 1N914
D7	03-20000	1			Diode, general purpose	1N4148 or 1N914
D8	03-20000	1			Diode, general purpose	1N4148 or 1N914
D9	03-20000	1			Diode, general purpose	1N4148 or 1N914
D10	03-20000	1			Diode, general purpose	1N4148 or 1N914
D11	03-20000	1			Diode, general purpose	1N4148 or 1N914
D12	03-20000	1			Diode, general purpose	1N4148 or 1N914
DS1	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS2	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS3	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS4	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS5	05-01013	1			LED,Green,Panel Mount	Hewlett Packard,5082-4955
DS6	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS7	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS8	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS9	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS10	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS11	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS12	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS13	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS14	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS15	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS16	05-01028	1			LED,Red,Panel Mount	Hewlett Packard,HLMP3301
DS17	05-01024	1			Display,LCD,4 1/2 Digit	IEEE,LCD5660R25K,0.375" Leads
IC1	03-30184	1			Hex invertor	74ALS04N or 74LS04N
IC2	03-50018		1		4300B IC2	Made from 03-30082
IC3	03-30210	1			1 of 10 Decoder	74145N
IC5	03-30025	1			Quad 2 Input Exclusive OR (CMOS)	4030BE
IC6	03-30022	1			LCD Display Driver (CMOS)	4054BE
IC7	03-30325		1		4-Digit LCD Driver	Intersil or Teledyne ICM7211AIPL
IC8	03-30048	1			Quad 2 Input AND (CMOS)	4081BE
IC9	03-30055	1			Quad 2 Input OR (CMOS)	4071BE
PL1	05-10372	1			Wafer,6 pin,gold,0.10 Sp,0.56 Lg	Molex 22-10-2061
PL3	05-10313	2			Wafer, 10 way, gold, 0.56 lg	Molex 22-10-2101
PL2A	05-10313	1			Wafer, 10 way, gold, 0.56 lg	Molex 22-10-2101
PL2B	05-10368	1			Wafer, 4 pin, gold, .56"	Molex 22-10-2041
R1	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R2	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R3	01-01041	1			1K 5% 1/4W Carbon Film	RC07GF102J
R4	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R5	01-01026	1			220 5% 1/4W Carbon Film	RC07GF221J
R6	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J

REF.DES.	STOCK #	QUANTITY A	QUANTITY T	QUANTITY N	DESCRIPTION	MANUFACTURING/PURCHASING DATA
R7	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R8	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R9	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R10	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R11	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R12	01-01041	1			1K 5% 1/4W Carbon Film	RC07GF102J
R13	01-01065	1			20K 5% 1/4W Carbon Film	RC07GF203J
R14	01-01033	1			470 5% 1/4W Carbon Film	RC07GF471J
RN1	01-40003	1			15 x 10K Network	A-B 316A-103
RN2	01-40009	1			8 x 220 Network	A-B 316B-221
SK1	05-10294	1			Socket, dil, 20 pin	Burndy DILB20P-108
SK2	05-10294	1			Socket, dil, 20 pin	Burndy DILB20P-108
SW1	05-03033	1			2701B BCD Rotary Switch	DWG 2701-050
TR1	03-10026	1			N-Channel VMOS (TO92)	VN10KM
TR2	03-10010	1			PNP Transistor (TO92)	2N4402
TR3	03-10010	1			PNP Transistor (TO92)	2N4402
TR4	03-10010	1			PNP Transistor (TO92)	2N4402
TR5	03-10010	1			PNP Transistor (TO92)	2N4402
TR6	03-10026	1			N-Channel VMOS (TO92)	VN10KM
TR7	03-10010	1			PNP Transistor (TO92)	2N4402
TR8	03-10013	1			NPN Transistor (TO92)	2N4401
XIC2	05-10008	1			Socket, dil, 16 pin	Burndy C8516-01
XIC7	05-10246	1			Socket, dil, 40 pin	Burndy DILB40P-11

REF.DES.	STOCK #	QUANTITY A	QUANTITY T	QUANTITY N	DESCRIPTION	MANUFACTURING/PURCHASING DATA
7	05-10340	6			Crimp Terminal,Gold,.10sp. housing, 22-30 AWG	Molex 08-55-0102
8	80-01120	8			20awg Wire, Brown PVC	M16878/1-BGE-1
9	80-01222	8			22awg Wire, Red PVC	M16878/1-BFE-2
10	80-01322	8			22awg Wire, Orange PVC	M16878/1-BFE-3
11	80-01422	8			22awg Wire, Yellow PVC	M16878/1-BFE-4
12	80-01522	8			22awg Wire, Green PVC	M16878/1-BFE-5
13	80-01622	8			22awg Wire, Blue PVC	M16878/1-BFE-6
A1	04-30111	1			4300B Switch Board	DWG 4300-704
SK1	05-10337	1			Connector housing, 6-way, 0.10 sp.	Molex 22-01-2061
SW1	05-03003	1			Switch, DPDT, Push-Push, Red knob	Centralab 004184
SW2	05-03003	1			Switch, DPDT, Push-Push, Red knob	Centralab 004184
SW4	05-03075	1			4300B Switch ASSY	DWG 4300-055

REF.DES.	STOCK #	QUANTITY A	QUANTITY T	QUANTITY N	DESCRIPTION	MANUFACTURING/PURCHASING DATA
6	4300-402	1			4300B Rear Panel ASSY	Assembly 4300-402
7	04-10527	1			4300B Front Panel (screened)	DWG 4300-100 using 04-10401
9	04-10458	2			2724A Side Rail	DWG 2724-215
10	04-10407	1			4300B Bottom Plate	DWG 4300-217
11	04-10827		1		2701C Top Cover (vinyl clad)	DWG 2701-223
12	04-10333	4			Standard Bezel	DWG 2724-205
13	04-10404	1			4300B Baffle	DWG 4300-218
14	04-10332	4			Standard Corner Block	DWG 2724-204
15	05-10015	2			Foot, rubber, white	Acc. Rubber 2089W-017
16	05-10431	2			Standoff, 1/4 hex, 3/8 lg, 6-32, M-F	RAF 4532-632-SS-0
17	05-10369	3			Standoff hinged, 1/4 dia, 1 lg, 6-32	Keystone 354
18	05-10096	4			Standoff, 1/4 dia, 1 lg, 6-32	Smith 2124 1"
19	05-10288	4			Spacer, 1/4 dia, 1/2 lg, #6, aluminum	Smith 8503
20	05-10371	3			Spacer, 1/4 dia, 3/16 lg, #6	Smith 9207
21	04-10304	2			4300B Capacitor Mounting Bracket	DWG 4300-212
22	92-06004	4			6-32 x 1/4" Phil Truss Head S.S.	
23	05-10067	1			Cable, power cord	Electrocord 39806
37	05-10340	4			Crimp Terminal,Gold,.10sp. housing, 22-30 AWG	Molex 08-55-0102
40	99-08100	2			#8 14-16awg Ring Lug (Blue)	ELCOM B3653-169
42	05-10261	7			Tie-wrap block, large	Panduit ABM2S-A
43	05-10073	5			Knob, black, rectangular	Centralab B304-BLK
44	05-10680	1			Knob,Black with Pointer Skirt	Rogan GRI-11-CSK-7-M
45	05-10808	2			Dual Tilting Feet (Plastic,Gray)	Elma Electronics 63-018S
46	91-06010	2			#6-32 x 5/8" Phil Flat 82 Deg. S.S.	
47	98-08002	4			#8 Internal Star Washer	
48	90-06204	2			#6-32 x 1/4" Phil Pan Black	
49	90-06006	9			#6-32 x 3/8" Phil Pan S.S.	
50	90-06009	2			#6-32 x 9/16" Phil Pan S.S.	
51	91-06006	21			#6-32 x 3/8" Phil Flat 82 Deg. S.S.	
52	91-08008	4			#8-32 x 1/2" Phil Flat S.S. 82 Deg.	
53	97-06001	13			#6-32 Hex Nut, SMALL PATTERN, S.S.	
54	98-06000	16			#6 Flat Washer STD S.S.	
55	98-06001	18			#6 Split Lock Washer,STD,S.S.	
56	98-06002	8			#6 Internal Star Washer, S.S.	
57	91-06009	8			#6-32 x 9/16" Phil Flat 82 Deg. S.S.	
58	05-10019	25			Cable tie, 4"x 1/8"	Panduit WRN-4
59	04-20043	1			Ferrite Bead,U850(.380D/.20ID/.20LG)	Amidon,FB-43-2401
60	80-10174	72			RG174/U Coax Cable, 50 ohm	Belden 8216
61	80-01016	55			16awg Wire, Black PVC	M16878/1-BJE-0
62	80-01116	20			16awg Wire, Brown PVC	M16878/1-BJE-1
63	80-01216	55			16awg Wire, Red PVC	M16878/1-BJE-2
64	80-01316	20			16awg Wire, Orange PVC	M16878/1-BKE-3
65	80-01516	4			16awg Wire, Green PVC	M16878/1-BJE-5
66	80-01120	10			20awg Wire, Brown PVC	M16878/1-BGE-1
67	80-01320	10			20awg Wire, Orange PVC	M16787/1-BGE-3
68	98-06004	9			#6 external Star 82Deg. S.S.	
69	98-08004	4			#8 Ext Star Washer 82 Deg	
70	03-20089	1			Metal Oxide Varistor 30V	Harris V36ZA80
A1	4300-602	1			4300B Main Board ASSY	Assembly 4300-602
A2	4300-603	1			4300B Display Board ASSY	ILLEGAL DWG 4300-603
A3	4300-605	1			4300B Output Board ASSY	Assembly 4300-605

REF.DES.	STOCK #	QUANTITY A	QUANTITY T	QUANTITY N	DESCRIPTION	MANUFACTURING/PURCHASING DATA
A4	4300-604	1			4300B Switch Board ASSY	Assembly 4300-604
C101	02-40007	1			110000u 20V Aluminum	Sangamo 500R114U020DF2B
J1	05-10021	1			Binding post, red, 30 amp	Superior BP30R
J2	05-10020	1			Binding post, black, 30 amp	Superior BP30B
J5	05-10021	1			Binding post, red, 30 amp	Superior BP30R
J6	05-10020	1			Binding post, black, 30 amp	Superior BP30B
SK1	05-10064	1			Connector, female, BNC, insulated, panel	Amphenol 31-010
SK3	05-10336	1			Connector housing, 2-way, 0.100 sp.	Molex 22-01-2021
SK5	05-10336	1			Connector housing, 2-way, 0.100 sp.	Molex 22-01-2021
SW1	05-03061	1			Switch,Power,Black,Yellow,2PDT	Schadow,ZFNE152UEE11010106B
T1	04-20044	1			4300B Power Transformer	DWG 4300-012

REF.DES.	STOCK #	QUANTITY A	QUANTITY T	QUANTITY N	DESCRIPTION	MANUFACTURING/PURCHASING DATA
1	04-10405	1			4300B Rear Panel	DWG 4300-219
2	70-00001	2			1/16" Black Shrink Tubing	M23053-5-102-0
3	80-02022	15			22Awg Wire, Black TFE	M16878/4-BFE-0
4	80-02222	15			22awg Wire,Red TFE	M16878/4-BFE-2
5	05-10980	1			Fan, 12VDC, 2 1/2"	Beckwith 314-343-6463
6	05-10390	1			Fan guard for 05-10389	Micronel V600
7	05-10482	2			Plug, hole, 1" dia, black	Heyco 2713
12	05-10086	2			Solder lug, #6, internal star	Smith 1412-6
13	90-04010	4			#4-40 x 5/8" Phil Pan S.S.	
14	90-06004	3			#6-32 x 1/4" Phil Pan S.S.	
15	90-06006	3			#6-32 x 3/8" Phil Pan S.S.	
16	98-06001	6			#6 Split Lock Washer,STD,S.S.	
17	97-06001	7			#6-32 Hex Nut, SMALL PATTERN, S.S.	
18	90-04004	2			#4-40 x 1/4" Phil Pan S.S.	
19	04-10305	1			4300B Butch Plate	DWG 4300-213
22	98-04001	2			#4 Split Lock Washer S.S.	
23	97-04001	6			#4-40 Radio Hex Nut S.S.	
24	91-06006	1			#6-32 x 3/8" Phil Flat 82 Deg. S.S.	
25	98-04000	4			#4 Flat Washer S.S.	
C2	02-30006	1			0.47u 35V Tantalum Bead	
F1	05-04011	1			3A,Slo Blo Fuse	Littlefuse,313-003
FX1	05-10018	1			Fuseholder, panel mount	Littlefuse 345061
IC211	03-30015	1			Regulator,+12V,0.5A,TO202 or TO220	78M12CP
PL1	05-10063	1			Connector, AC, receptacle	Switchcraft EAC-301
SW2	05-03017	1			Slide Switch,115/230V,2Pole	Switchcraft,4625LFR
TB1	05-10050	1			Terminal, solder, #6	Smith 3005

REF.DES.	STOCK #	QUANTITY A	QUANTITY T	QUANTITY N	DESCRIPTION	MANUFACTURING/PURCHASING DATA
2	05-10244	1			IEEE connector hardware kit	AMP 552633-3
3	80-01222	7			22awg Wire, Red PVC	M16878/1-BFE-2
4	80-01022	7			22awg Wire, Black PVC	M16878/1-BFE-0
5	05-10086	1			Solder lug, #6, internal star	Smith 1412-6
7	90-06006	4			#6-32 x 3/8" Phil Pan S.S.	
8	05-10340	24			Crimp Terminal,Gold,.10sp. housing, 22-30 AWG	Molex 08-55-0102
9	70-00004	1			1/4" Black Shrink Tubing FP301	3M 3000250BK
10	80-01124	48			24awg Wire, Brown PVC	M16878/1-BEE-1
11	80-01224	72			24awg Wire, Red PVC	M16878/1-BEE-2
12	80-01324	72			24awg Wire, Orange PVC	M16878/1-BEE-3
13	80-01424	48			24awg Wire, Yellow PVC	M16878/1-BEE-4
14	80-01524	48			24awg Wire, Green PVC	M16878/1-BEE-5
15	80-01624	48			24awg Wire, Blue PVC	M16878/1-BEE-6
16	80-01724	72			24awg Wire, Voilet PVC	M16878/1-BEE-7
17	80-01824	72			24awg Wire, Gray PVC	M16878/1-BEE-8
18	80-01924	72			24awg Wire, White PVC	M16878/1-BEE-9
19	80-01024	48			24awg Wire, Black TFE	M16878/1-BEE-0
20	80-01516	8			16awg Wire, Green PVC	M16878/1-BJE-5
21	05-10019	18			Cable tie, 4"x 1/8"	Panduit WRN-4
23	91-06008	2			#6-32 x 1/2" Phil Flat 82 Deg. S.S.	
24	98-06001	4			#6 Split Lock Washer,STD,S.S.	
25	97-06000	4			#6-32 Standard Hex Nut, S.S.	
28	04-30084	1			IEEE 488 Board	DWG 1000-700
29	04-10296	2			IEEE/IOX support bracket	DWG 2300-216
31	90-06006	4			#6-32 x 3/8" Phil Pan S.S.	
32	98-06001	3			#6 Split Lock Washer,STD,S.S.	
33	97-06001	4			#6-32 Hex Nut, SMALL PATTERN, S.S.	
40	90-04504	2			4-40 x 1/4,Self-Tap,Phil,Pan hd,S.S.,Type AB	
C1	02-30014	1			100u 10V Tantalum Bead	AVX TAP106K025SP
C2	02-20018	1			33p 500V Mica	CM05FD330J03
C3	02-20018	1			33p 500V Mica	CM05FD330J03
C4	02-10006	1			0.01uF 50V Ceramic disc	Illinois 103GR050-Z
C5	02-10006	1			0.01uF 50V Ceramic disc	Illinois 103GR050-Z
C6	02-10006	1			0.01uF 50V Ceramic disc	Illinois 103GR050-Z
C7	02-10006	1			0.01uF 50V Ceramic disc	Illinois 103GR050-Z
C8	02-30002	1			33uF 10V Tantalum Bead	IDC336K010NLF
C9	02-30002	1			33uF 10V Tantalum Bead	IDC336K010NLF
D1	03-20000	1			Diode, general purpose	1N4148 or 1N914
IC1	03-30156	1			Octal 3-State Buffer	74ALS541N or 74LS541N
IC2	03-30157	1			Octal GPIB Transceiver (Thin Package)	Motorola MC3447P3
IC3	03-30157	1			Octal GPIB Transceiver (Thin Package)	Motorola MC3447P3
IC4	03-30158		1		GPIB to MPU Interface	MC68488P
IC5	03-30160		1		Microprocessor with RAM (1MHz)	MC6802P
IC6	03-50022		1		4300B TL-488 ROM	Made from 03-30154
IC7	03-30155	1			Binary to 1 of 8 decoder	74ALS138N or 74LS138N
IC9	03-30159		1		Peripheral Interface Adapter (1.5MHz)	MC68A21P
IC11	03-30159		1		Peripheral Interface Adapter (1.5MHz)	MC68A21P
IC12	03-30184	1			Hex invertor	74ALS04N or 74LS04N
IC13	03-30034	1			Regulator,+5V,0.5A,TO202 or TO220	78M05CP or LM340T-5.0
PL2	05-10445	1			Connector, housing, 14 way, 0.10 sp.	Molex 22-01-2141
PL3	05-10444	1			Connector, housing, 20 way, 0.10 sp.	Molex 22-01-2201

REF.DES.	STOCK #	QUANTITY A	QUANTITY T	QUANTITY N	DESCRIPTION	MANUFACTURING/PURCHASING DATA
R1	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R2	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R3	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R4	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R5	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R6	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R7	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R9	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
R11	01-01061	1			10K 5% 1/4W Carbon Film	RC07GF103J
S1	05-03091	1			Switch,Dip,Rt. Angle,5 Position	Grayhill,76PSB05
SK5	05-10243	1			Connector, 24 way, right angle	AMP 552791-1
TR2	03-10013	1			NPN Transistor (TO92)	2N4401
TR4	03-10013	1			NPN Transistor (TO92)	2N4401
XIC4	05-10246	1			Socket, dil, 40 pin	Burndy DILB40P-11
XIC5	05-10246	1			Socket, dil, 40 pin	Burndy DILB40P-11
XIC6	05-10042	1			Socket, dil, 24 pin	TI 8524-01
XIC9	05-10246	1			Socket, dil, 40 pin	Burndy DILB40P-11
XIC11	05-10246	1			Socket, dil, 40 pin	Burndy DILB40P-11
Y1	05-02004	1			Crystal,MPU,4MHz	HC18-4MHz

REF.DES.	STOCK #	QUANTITY A	QUANTITY T	QUANTITY N	DESCRIPTION	MANUFACTURING/PURCHASING DATA
2	05-10340	2			Crimp Terminal,Gold,.10sp. housing, 22-30 AWG	Molex 08-55-0102
3	05-10336	1			Connector housing, 2-way, 0.100 sp.	Molex 22-01-2021
4	90-04006	8			#4-40 x 3/8" Phil Pan S.S.	
5	97-04001	8			#4-40 Radio Hex Nut S.S.	
6	98-04001	8			#4 Split Lock Washer S.S.	
7	70-00004	2			1/4" Black Shrink Tubing FP301	3M 3000250BK
8	05-10066	2			Connector, 4 pin, female free	Amphenol
9	05-10093	2			Strain relief, threaded	Bendix MS3057-8 Silver
12	80-01214	20			14awg Wire, Red PVC	M16878/1-BKE-2
13	80-01014	20			14awg Wire, Black PVC	M16878/1-BKG-0
14	80-10174	24			RG174/U Coax Cable, 50 ohm	Belden 8216
15	80-01022	2			22awg Wire, Black PVC	M16878/1-BFE-0
16	70-00002	2			1/8" Black Shrink Tubing FP301	3M 3000125BK
J3	05-10065	1			Connector, 4 pin, male, Chassis mount	Amphenol MS3102A16-9P-639
J4	05-10065	1			Connector, 4 pin, male, Chassis mount	Amphenol MS3102A16-9P-639

REF.DES.	STOCK #	QUANTITY A	T	N	DESCRIPTION	MANUFACTURING/PURCHASING DATA
7	04-30076	1			4300B "BCD" Board	DWG 4300-709
9	05-10444	1			Connector, housing, 20 way, 0.10 sp.	Molex 22-01-2201
10	05-10340	20			Crimp Terminal,Gold,.10sp. housing, 22-30 AWG	Molex 08-55-0102
14	05-10244	1			IEEE connector hardware kit	AMP 552633-3
15	04-10303	1			4300B "BCD" Butch Plate	DWG 4300-211
16	80-01124	50			24awg Wire, Brown PVC	M16878/1-BEE-1
17	80-01224	50			24awg Wire, Red PVC	M16878/1-BEE-2
18	80-01324	50			24awg Wire, Orange PVC	M16878/1-BEE-3
19	80-01424	50			24awg Wire, Yellow PVC	M16878/1-BEE-4
20	80-01524	50			24awg Wire, Green PVC	M16878/1-BEE-5
21	80-01624	50			24awg Wire, Blue PVC	M16878/1-BEE-6
22	80-01724	25			24awg Wire, Voilet PVC	M16878/1-BEE-7
23	80-01824	50			24awg Wire, Gray PVC	M16878/1-BEE-8
24	80-01924	50			24awg Wire, White PVC	M16878/1-BEE-9
25	80-01024	50			24awg Wire, Black TFE	M16878/1-BEE-0
IC1	03-30039	1			Quad Latch (CMOS)	4042BE
IC2	03-30039	1			Quad Latch (CMOS)	4042BE
IC3	03-30039	1			Quad Latch (CMOS)	4042BE
IC4	03-30039	1			Quad Latch (CMOS)	4042BE
IC5	03-30039	1			Quad Latch (CMOS)	4042BE
IC6	03-30147	1			4-Bit adder (CMOS)	4008BE
IC7	03-30055	1			Quad 2 Input OR (CMOS)	4071BE
IC8	03-30136	1			Dual 4 input NOR (CMOS)	4002BE
J1	05-10169	1			Connector, female 24 way	Amphenol 57-20240-2
R1	01-01081	1			100K 5% 1/4W Carbon Film	RC07GF104J
R2	01-01081	1			100K 5% 1/4W Carbon Film	RC07GF104J

SECTION XII DRAWINGS AND SCHEMATICS

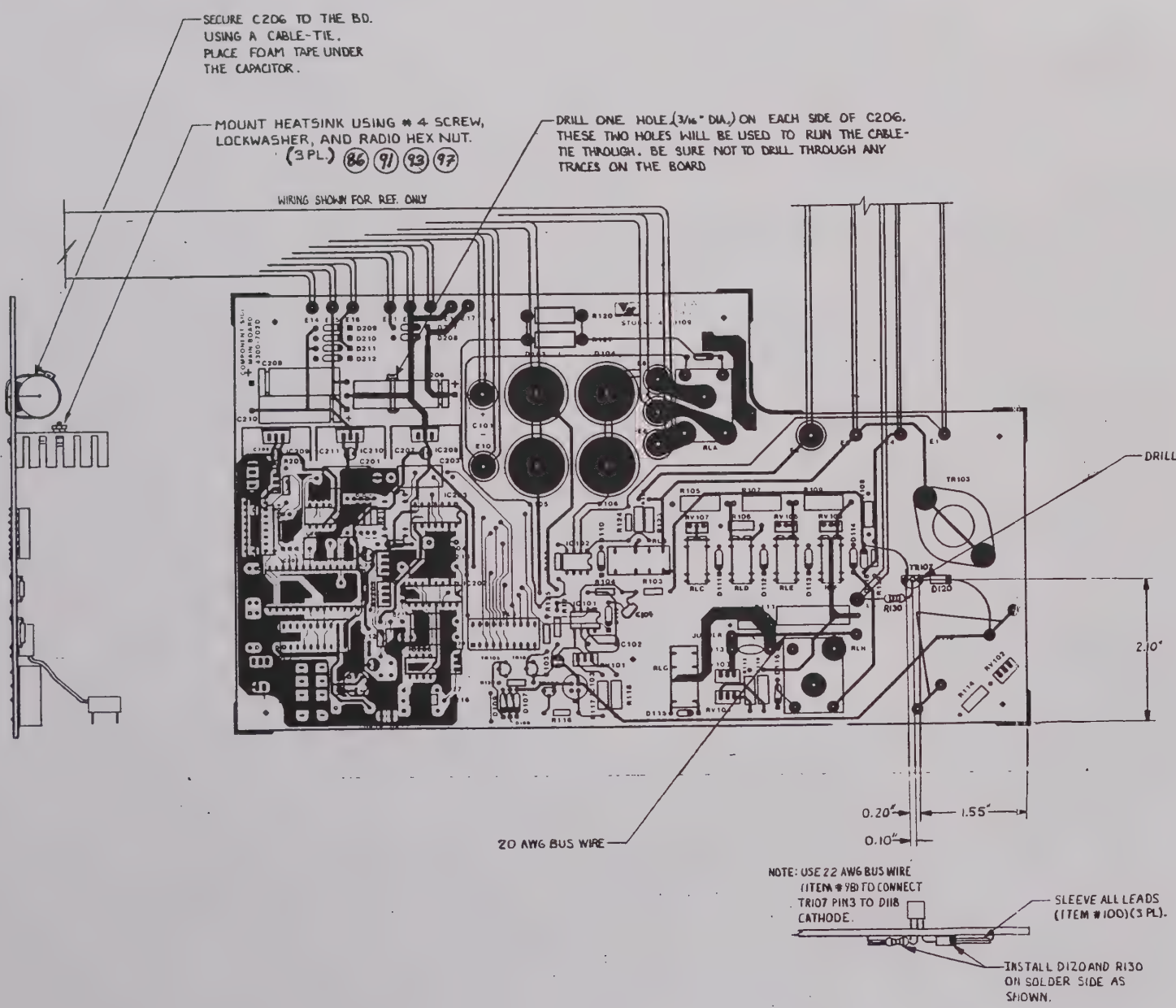
The following schematic diagrams have been included in this manual:

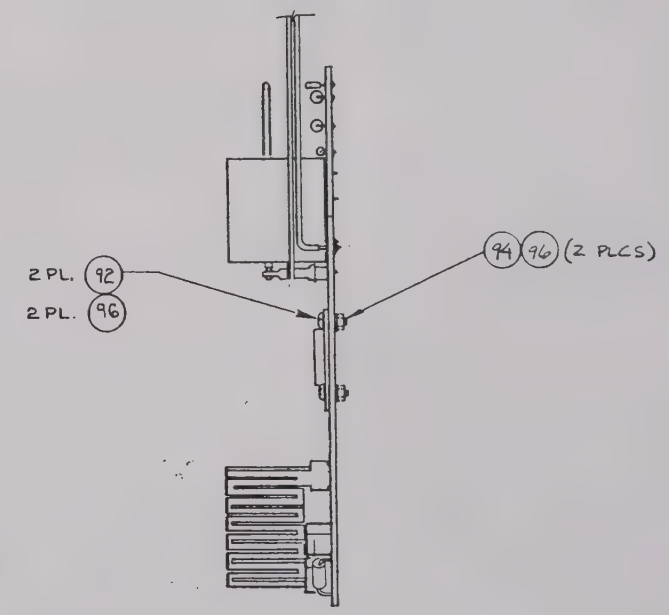
4300-602	1 page	Main PCB Assembly
4300-605	1 page	Output PCB Assembly
4300-072	2 pages	Main PCB Schematic
4300-603	1 page	Display PCB Assembly
4300-604	1 page	Switch PCB Assembly
4300-073	2 pages	Display PCB Schematic
4300-401	1 page	Chassis Assembly
4300-402	1 page	Rear Panel Assembly
4300-075	1 page	Chassis Wiring Schematic
4300-403	1 page	Option TL-488 GPIB Installation
1000-600	1 page	Option TL-488 Board Assembly
1000-070	1 page	Option TL-488 Schematic
4300-407	1 page	Option JB-2 Assembly
4300-609	1 page	Option BCD Interface Assembly
4300-051	1 page	Option IDC-3 BCD Interface Cable
4300-079	1 page	Option BCD Interface Schematic

REVISIONS				
ECO	LTR	DESCRIPTION	DATE	APPROVED

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. CLAD SHOWN IS COMPONENT SIDE.


SECURE C206 TO THE BD. USING A CABLE-TIE. PLACE FOAM TAPE UNDER THE CAPACITOR.
MOUNT HEATSINK USING # 4 SCREW, LOCKWASHER, AND RADIO HEX NUT. (3 PL.) (86) (91) (93) (97)
DRILL ONE HOLE (3/16" DIA.) ON EACH SIDE OF C206. THESE TWO HOLES WILL BE USED TO RUN THE CABLE-TIE THROUGH. BE SURE NOT TO DRILL THROUGH ANY TRACES ON THE BOARD
WIRING SHOWN FOR REF. ONLY
DRILL 0.04 DIA (3PL)
2.10"
20 AWG BUS WIRE
0.20"
1.55"
0.10"
NOTE: USE 22 AWG BUS WIRE (ITEM # 98) TO CONNECT TRI07 PIN 3 TO D118 CATHODE.
SLEEVE ALL LEADS (ITEM # 100) (3 PL).
INSTALL D120 AND R130 ON SOLDER SIDE AS SHOWN.



DASH NO	QTY REQD	NEXT ASSEMBLY	USED ON
	1	4300-400	4300B

TOLERANCES
X" = ± 30'
.XX = ± .03
.XXX = ± .010

MATERIAL

BREAK ALL SHARP CORNERS AND EDGES, MACH SURFACES 63

FINISH

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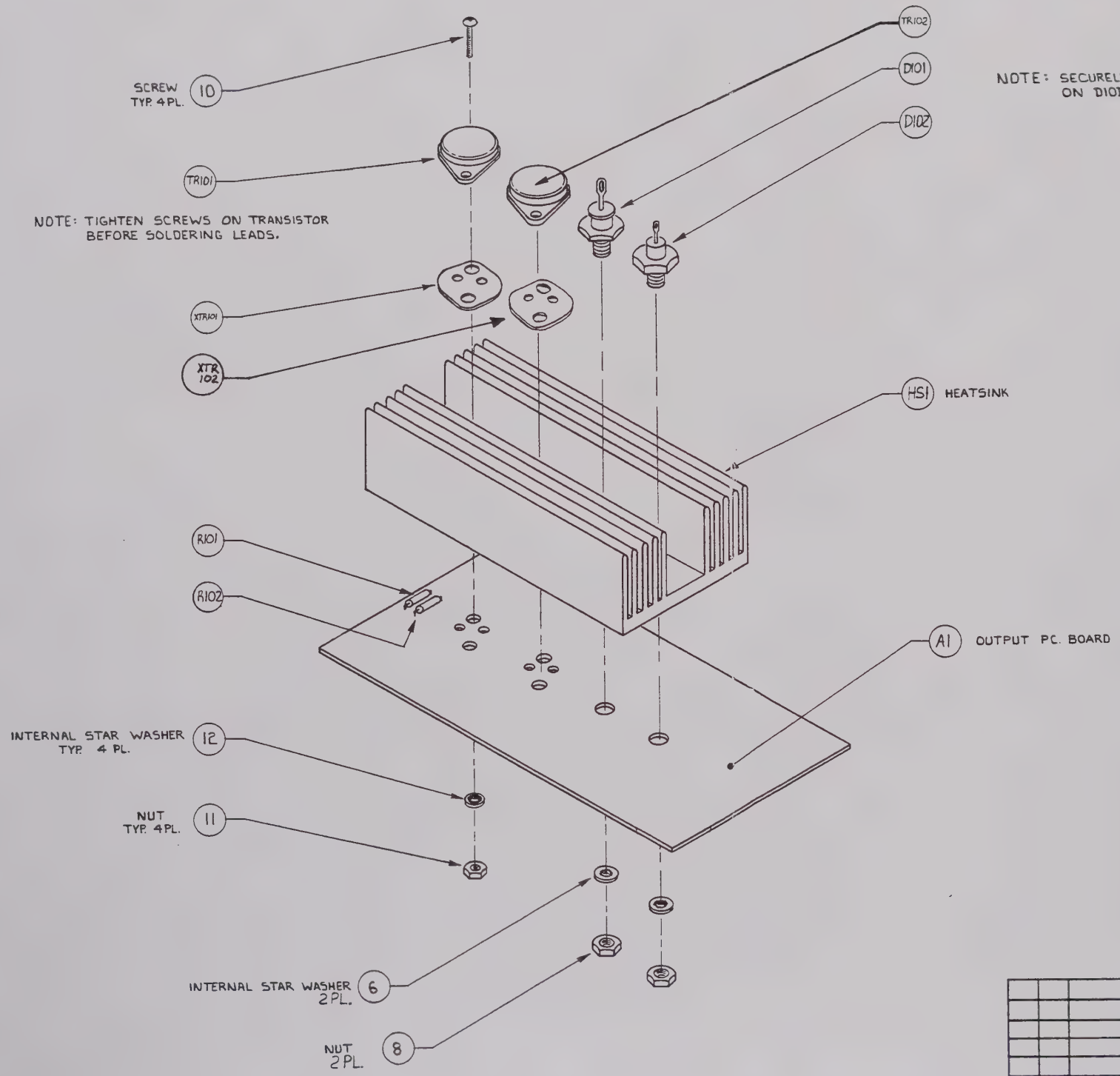
SAN DIEGO, CA

MAIN P.C.B. ASSEMBLY

SCALE	CODE IDENT	SIZE	DRAWING NO	REV
SHEET 1 OF 1	53504	D	4300-602	LS

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. FOR WIRING SEE WIRE TAB TABLE.
2. FOR PARTS LIST SEE 4300-605



DASH NO	QTY REQD	NEXT ASSEMBLY	USED ON
	1	4300-401	4300B

TOLERANCES: X° = ± 30' .XX = ± .03 .XXX = ± .010

MATERIAL: S

BREAK ALL SHARP CORNERS AND EDGES, MACH SURFACES 63 ✓

FINISH: S

Valhalla Scientific Inc. SAN DIEGO, CA

OUTPUT P.C.B. ASSY.

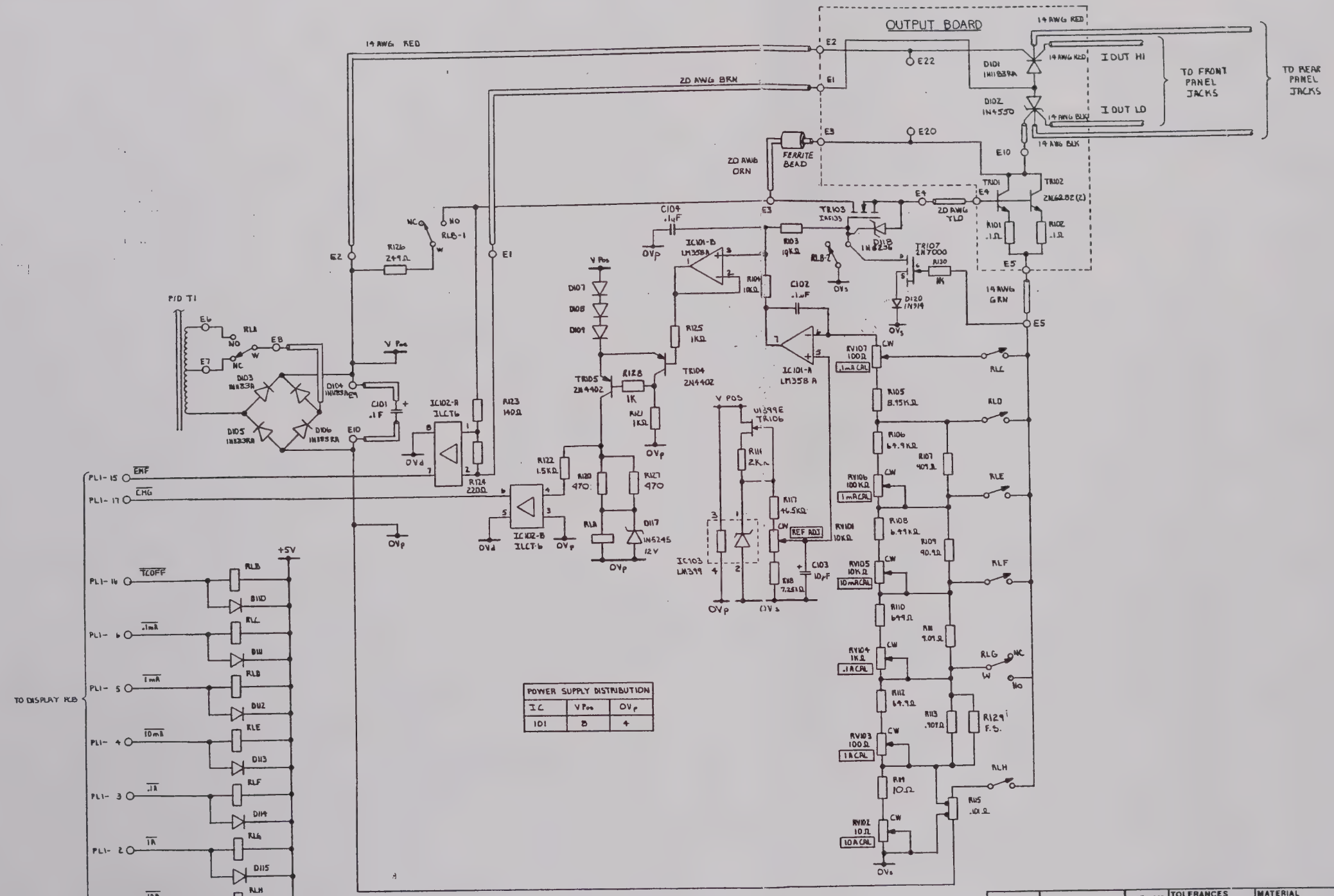
SCALE ——— SHEET 1 OF 1

CODE IDENT	SIZE	DRAWING NO	REV
53504	D	4300-605	F

REVISIONS				
ECO	LTR	DESCRIPTION	DATE	APPROVED

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL UNMARKED DIODES ARE 1N4148



POWER SUPPLY DISTRIBUTION		
IC	V Pos	OV p
101	8	4

FIRST USED	NOT USED	LAST USED
C101		C104
D101		D119
IC101		IC103
R101		R130
RV101		RV107
RLA		RLH
DASH NO / QTY REQD	NEXT ASSEMBLY	USED ON

TOLERANCES: X = ± .10, .XX = ± .03, .XXX = ± .010

MATERIAL

BREAK ALL SHARP CORNERS AND EDGES. MACH SURFACES 64

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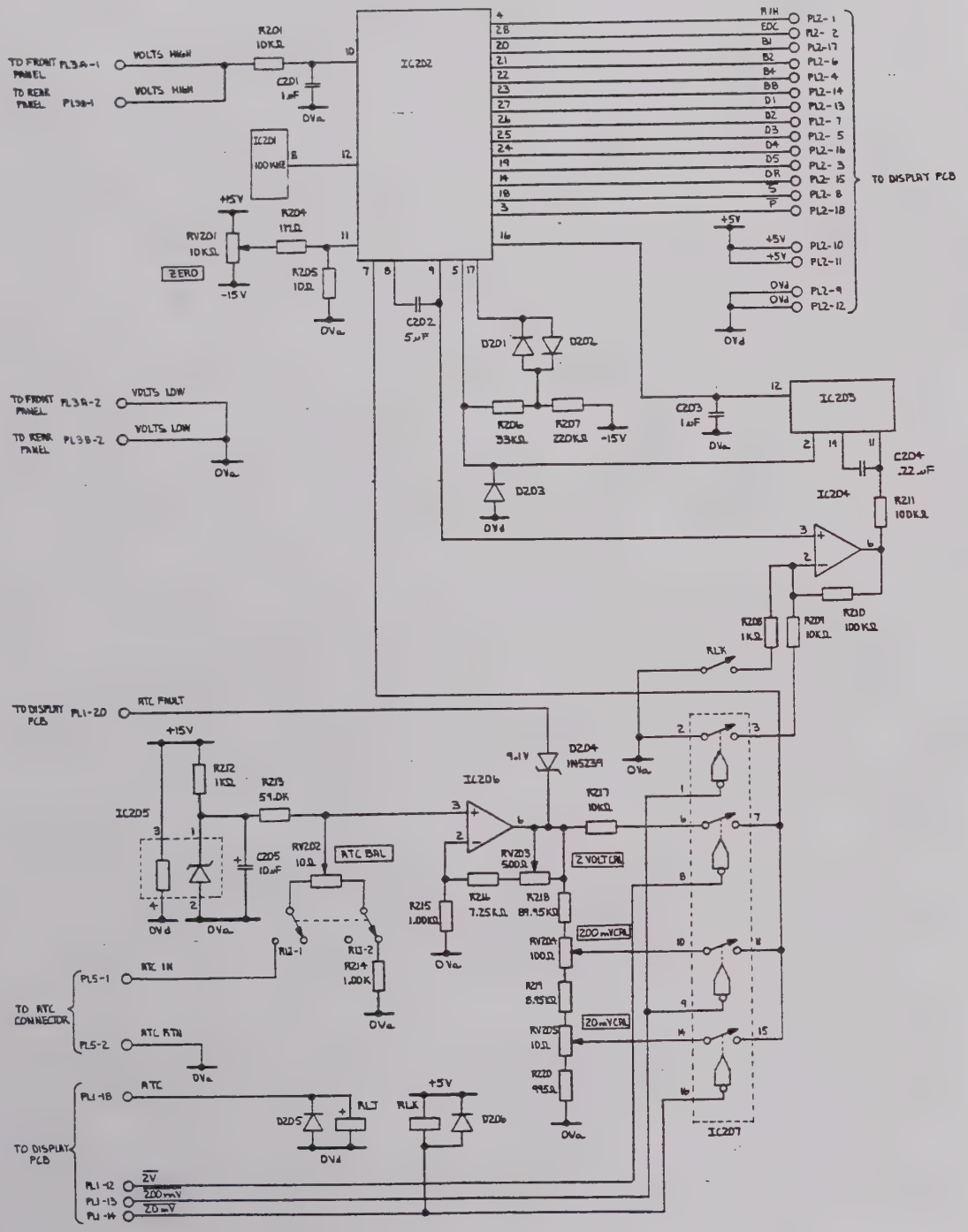
4300B MAIN PCB

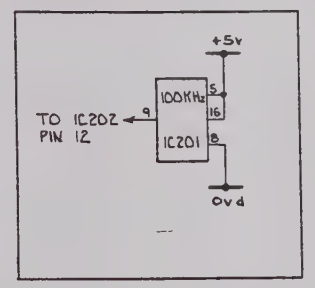
SCALE	CODE IDENT	SIZE	DRAWING NO	REV
SHEET 1 OF 2	53504	D	4300-072	G

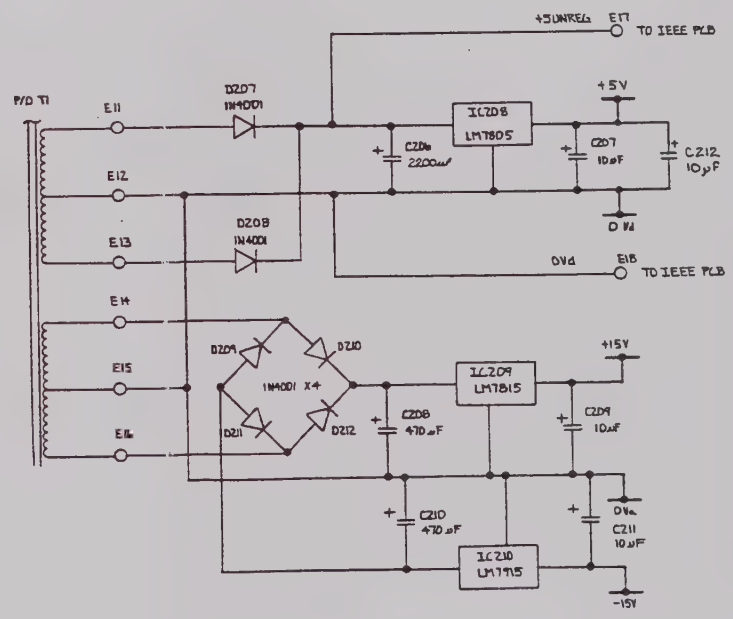
NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL UNMARKED DIODES ARE 1N4448



EITHER VERSION OF IC201 CAN BE FITTED IN BOARD





POWER SUPPLY DISTRIBUTION						FIRST USED	NOT USED	LAST USED
IC	+15V	-15V	+5V	0Va	0Vd	C201	—	C211
IC201	—	—	14	—	7	D201	—	D212
IC202	—	6	1	—	15	IC201	—	IC210
IC203	8	1	—	5.10.13	—	PL1	—	PL5
IC204 IC206	7	4	—	—	—	RZ01	—	RZ20
IC207	15	4	—	5	—	RV201	—	RV205
						RL3	—	RL K

TOLERANCES: X = ± 30' .XX = ± .03 .XXX = ± .010

MATERIAL

BREAK ALL SHARP CORNERS AND EDGES. MACH SURFACES 64

FINISH

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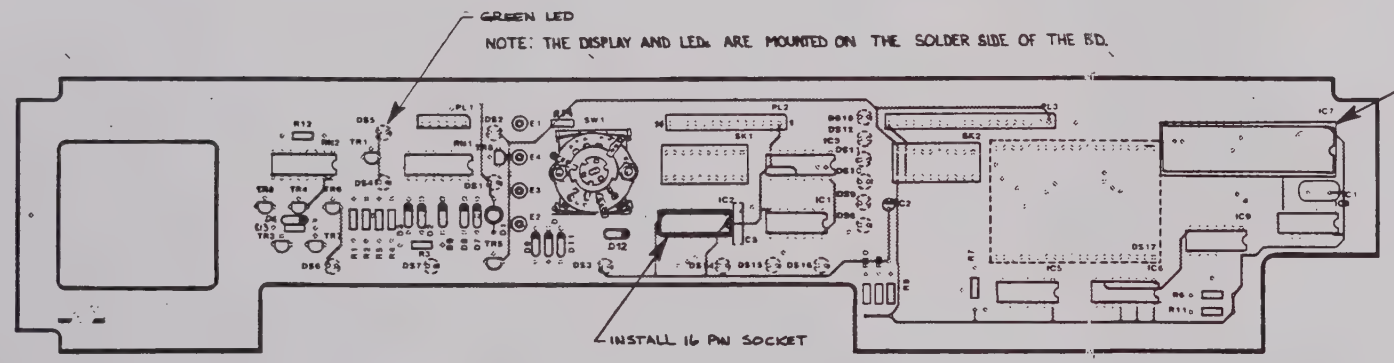
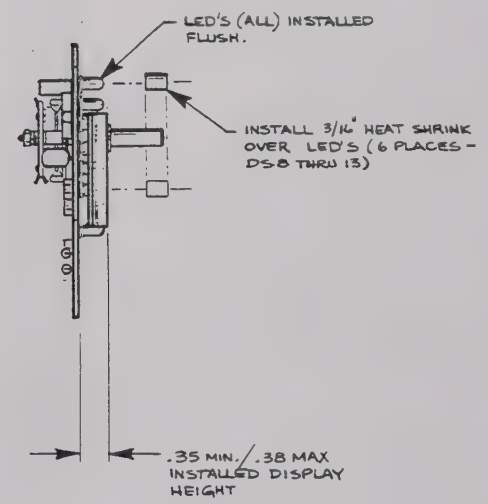
4300B MAIN PCB

SCALE	CODE IDENT	SIZE	DRAWING NO	REV
SHEET 2 OF 2	53504	D	4300-072	F

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. FOR PARTS LIST, SEE SHEETS 1 & 2.
2. FOR SCHEMATIC, SEE DWG NO. 4300-073



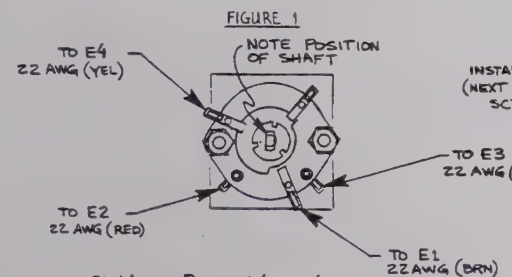


COMPONENT SIDE SHOWN

ROTARY SWITCH ASSEMBLY

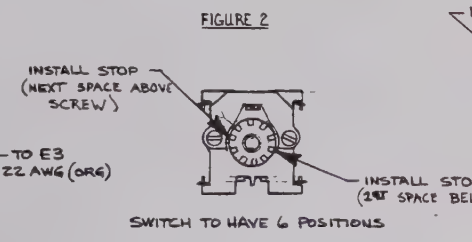
1. ROTATE SWITCH TO POSITION SHOWN IN FIGURE 1, BELOW.
2. INSTALL THE TWO ADJUSTABLE STOPS AS SHOWN IN FIGURE 2, BELOW.
3. SECURE STOPS WITH NUT AS SHOWN IN FIGURE 3 BELOW. SWITCH SHOULD HAVE 6 POSITIONS.
4. MOUNT ROTARY SWITCH ASSEMBLY TO DISPLAY PCB USING NUT AND INTERNAL STAR WASHER AS SHOWN IN FIGURE 3 BELOW.

FIGURE 1



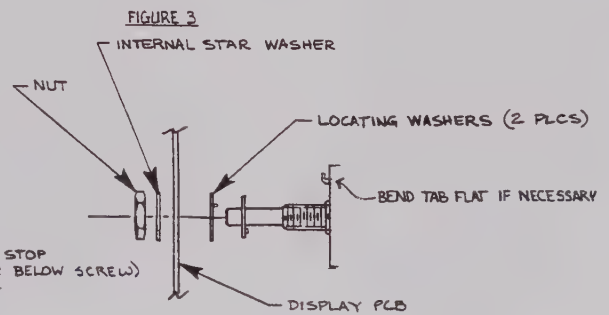
SW1 - REAR VIEW (AS INSTALLED)

FIGURE 2



SW1 - FRONT VIEW (AS INSTALLED)

FIGURE 3



SW1 MOUNTING DETAIL

DASH NO	QTY REQD	NEXT ASSEMBLY	USED ON

TOLERANCES: X = ± 30' ; .XX = ± .03 ; .XXX = ± .010

MATERIAL

BREAK ALL SHARP CORNERS AND EDGES, MACH SURFACES 64

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DISPLAY BD ASSY

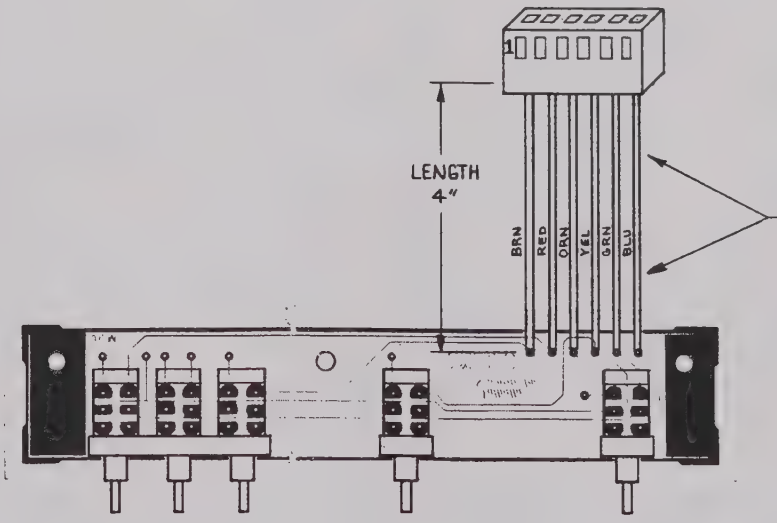
SCALE	CODE IDENT	SIZE	DRAWING NO	REV
1:1	53504	D	4300-603	J

SHEET 1 OF 1

NOTES:

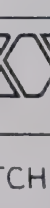
1. ALL WIRES ARE 22 AWG.

REVISIONS				
ECO	LTR	DESCRIPTION	DATE	APPROVED



USE 2 TY-WRAPS TO BIND WIRES TOGETHER.

NOTE: CRIMP WIRE TO TERMINAL THEN INSERT INTO PROPER HOUSING SLOT.



SWITCHES ARE TO BE MOUNTED .062" ABOVE BOARD.

CUT OFF TOP TERMINALS ON ALL SWITCHES.

DASH NO	QTY REQD	NEXT ASSEMBLY	USED ON
	1	4300-400	4300B

TOLERANCES
X° = ± 30'
.XX = ± .03
.XXX = ± .010

MATERIAL

FINISH

BREAK ALL SHARP CORNERS AND EDGES. MACH SURFACES 63

DRAWN WP
CHECKED
APPR
STK NO

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SWITCH P.C.B. ASSEMBLY

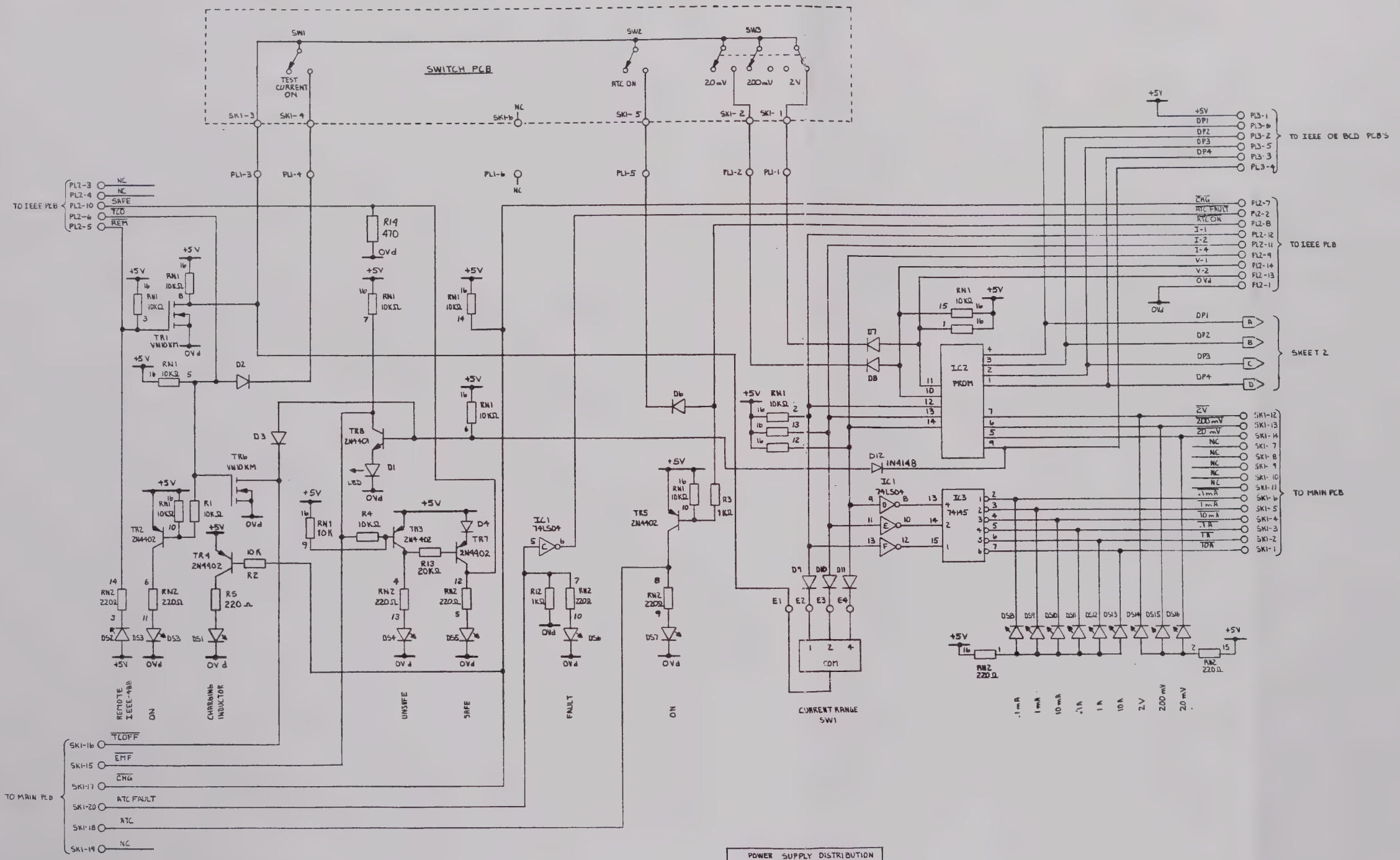
SCALE	CODE IDENT	SIZE	DRAWING NO	REV
NONE	53504	C	4300-604	A

SHEET 1 OF 1

4300-604 A

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL UNMARKED DIODES ARE 1N9148.



POWER SUPPLY DISTRIBUTION		
IC	+5V	OVd
1	14	7
2	16	8, 15
3	16	8, 12

FIRST USED	NOT USED	LAST USED
D1	D5	D11
DS1	——	DS16
IC1	——	IC3
RN1	——	RN2
R1	R6 - R11	R14
TR1	——	TR8
DASH NO	QTY REQD	NEXT ASSEMBLY / USED ON

TOLERANCES
X = ± 30'
.XX = ± .03
.XXX = ± .010

BREAK ALL SHARP CORNERS AND EDGES, MACH SURFACES 64

MATERIAL

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CHECKED
APPR
STK NO

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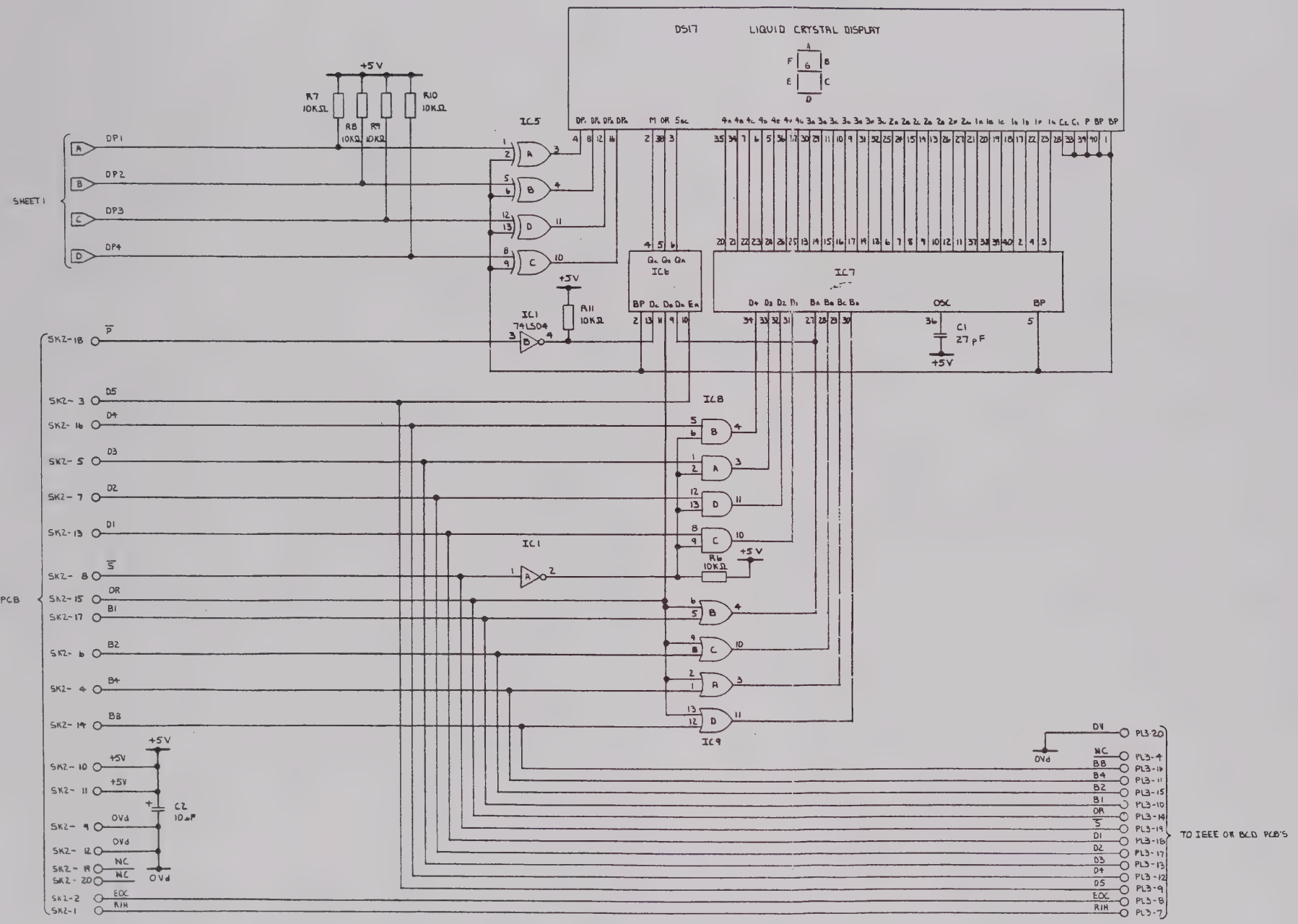
4300B DISPLAY PCB

SCALE	CODE IDENT	SIZE	DRAWING NO	REV
SHEET 1 OF 2	53504	D	4300-073	B

NOTES: (UNLESS OTHERWISE SPECIFIED)

REVISIONS				
ECO	LTR	DESCRIPTION	DATE	APPROVED



POWER SUPPLY DISTRIBUTION		
IC	+5V	OVd
5,8,9	14	7
6	12, 14, 16	7,8
7	1	35

FIRST USED	NOT USED	LAST USED
C1		C2
IC1	IC2 IC3 IC4 IC5	IC9
PL3		PL3
R6		R11
SK2		SK2
DASH NO / QTY REQD	NEXT ASSEMBLY	USED ON

TOLERANCES
X = ± 30'
.XX = ± .03
.XXX = ± .010

BREAK ALL SHARP CORNERS AND EDGES. MACH SURFACES 64

MATERIAL

FINISH

DRAWN
CHECKED
APPR
STK NO

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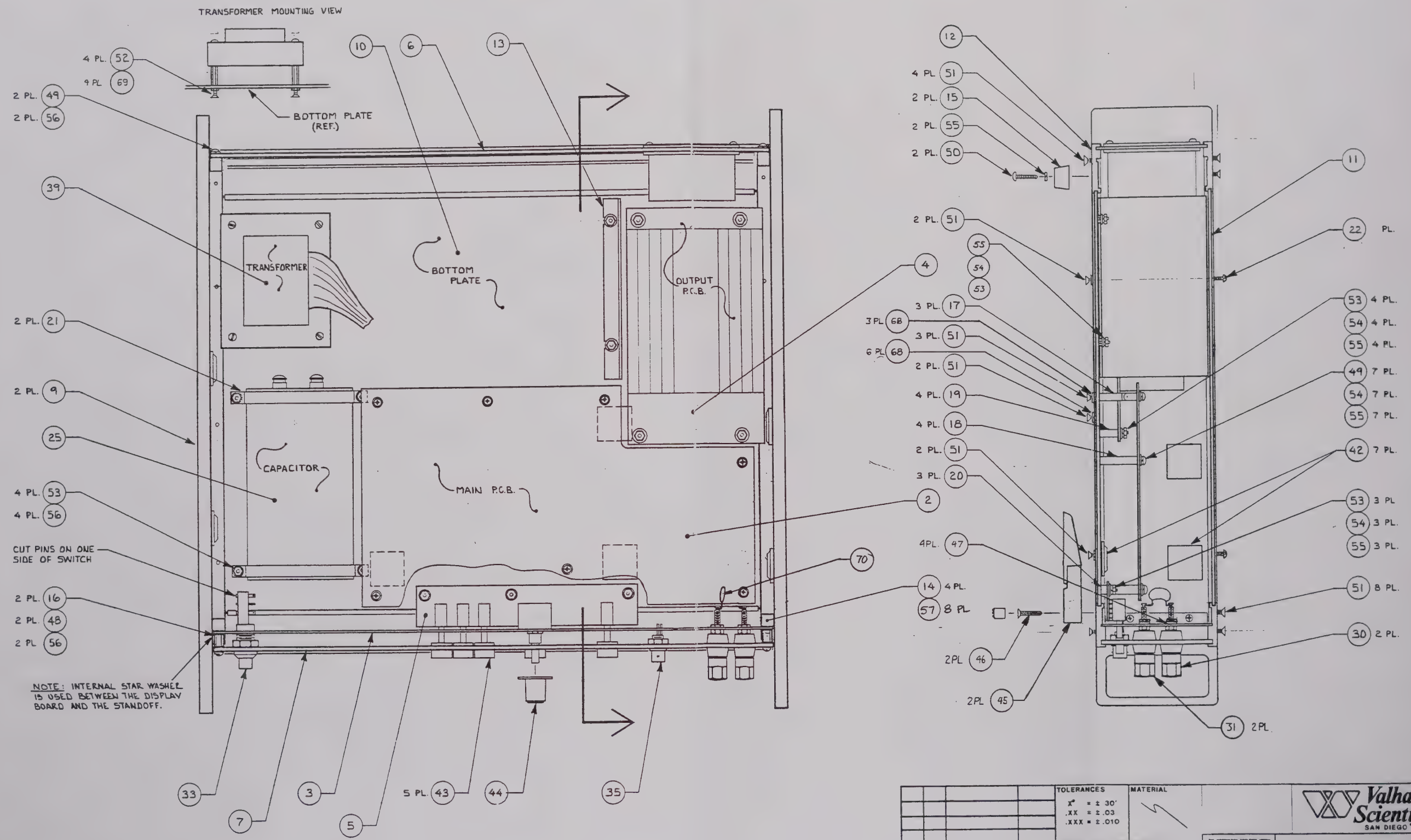
4300B DISPLAY PCB

SCALE	CODE IDENT	SIZE	DRAWING NO	REV
	53504	D	4300-073	B

SHEET 2 OF 2

NOTES: (UNLESS OTHERWISE SPECIFIED)



DASH NO	QTY REQD	NEXT ASSEMBLY	USED ON

TOLERANCES
X° = ± 30'
.XX = ± .03
.XXX = ± .010

MATERIAL

BREAK ALL SHARP CORNERS AND EDGES. MACH SURFACES 63

FINISH

Valhalla Scientific Inc.
SAN DIEGO, CA

4300B CHASSIS ASSY.

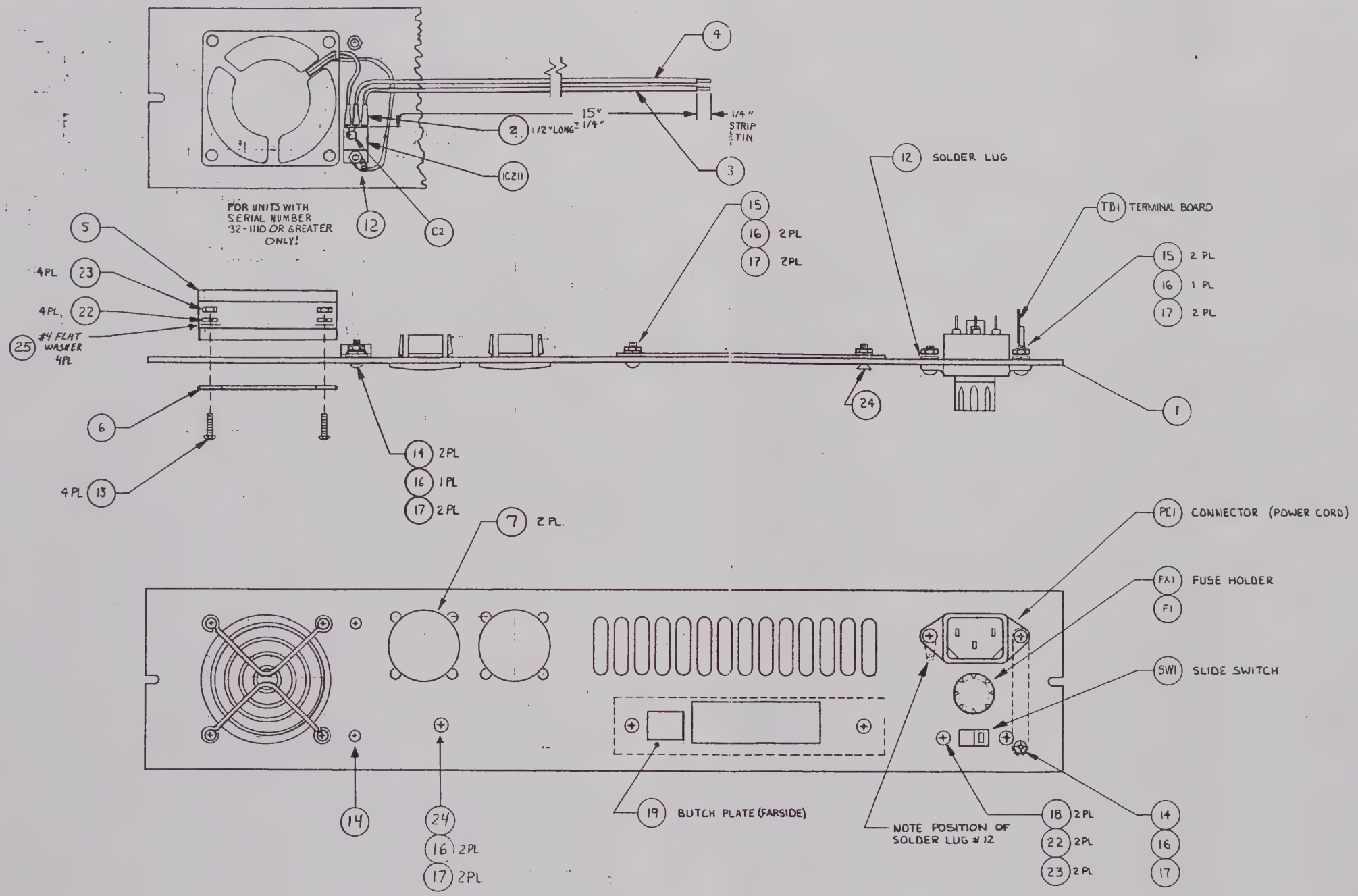
SCALE	CODE IDENT	SIZE	DRAWING NO	REV
3/4 = 1	53504	D	4300-401	P

SHEET 1 OF 1

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. SEE SEPARATE PARTS LIST.

REVISIONS				
ECO	LTR	DESCRIPTION	DATE	APPROVED



DASH NO	QTY REQD	NEXT ASSEMBLY	USED ON
	1	4300-401	4300B

TOLERANCES: X = ± 30' ; .XX = ± .03 ; .XXX = ± .010

BREAK ALL SHARP CORNERS AND EDGES. MACH SURFACES 64

MATERIAL

FINISH

Valhalla Scientific Inc. SAN DIEGO, CA

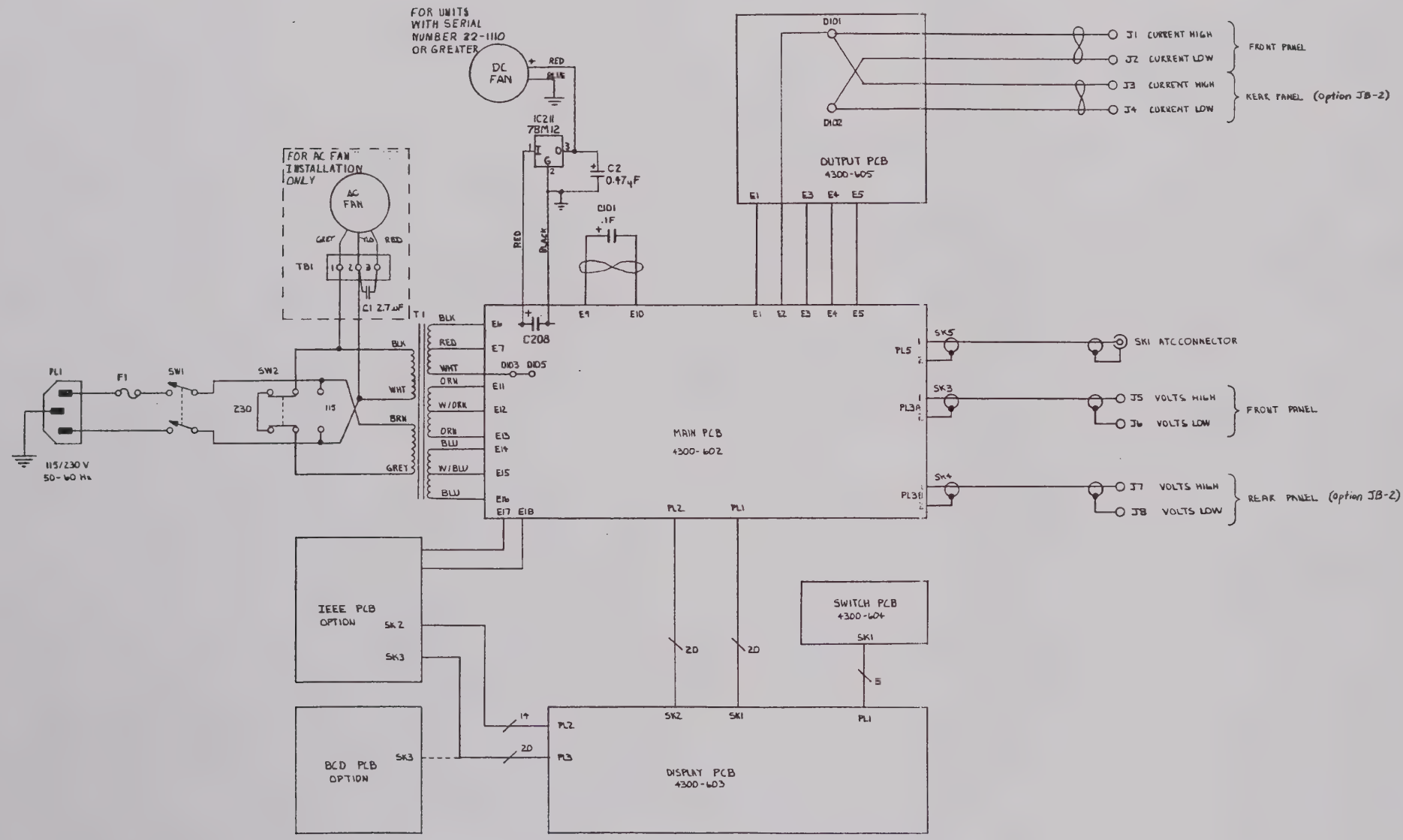
4300B REAR PANEL ASSY.

SCALE NONE | SHEET 1 OF 1

CODE IDENT	SIZE	DRAWING NO	REV
53504	D	4300-402	K

NOTES: (UNLESS OTHERWISE SPECIFIED)

REVISIONS				
ECO	LTR	DESCRIPTION	DATE	APPROVED



DASH NO	QTY REQD	NEXT ASSEMBLY	USED ON

TOLERANCES
X = ± 30'
.XX = ± .03
.XXX = ± .010

BREAK ALL SHARP CORNERS AND EDGES. MACH SURFACES 64

MATERIAL

FINISH

Valhalla Scientific Inc.
SAN DIEGO, CA

4300 B CHASSIS WIRING

SCALE

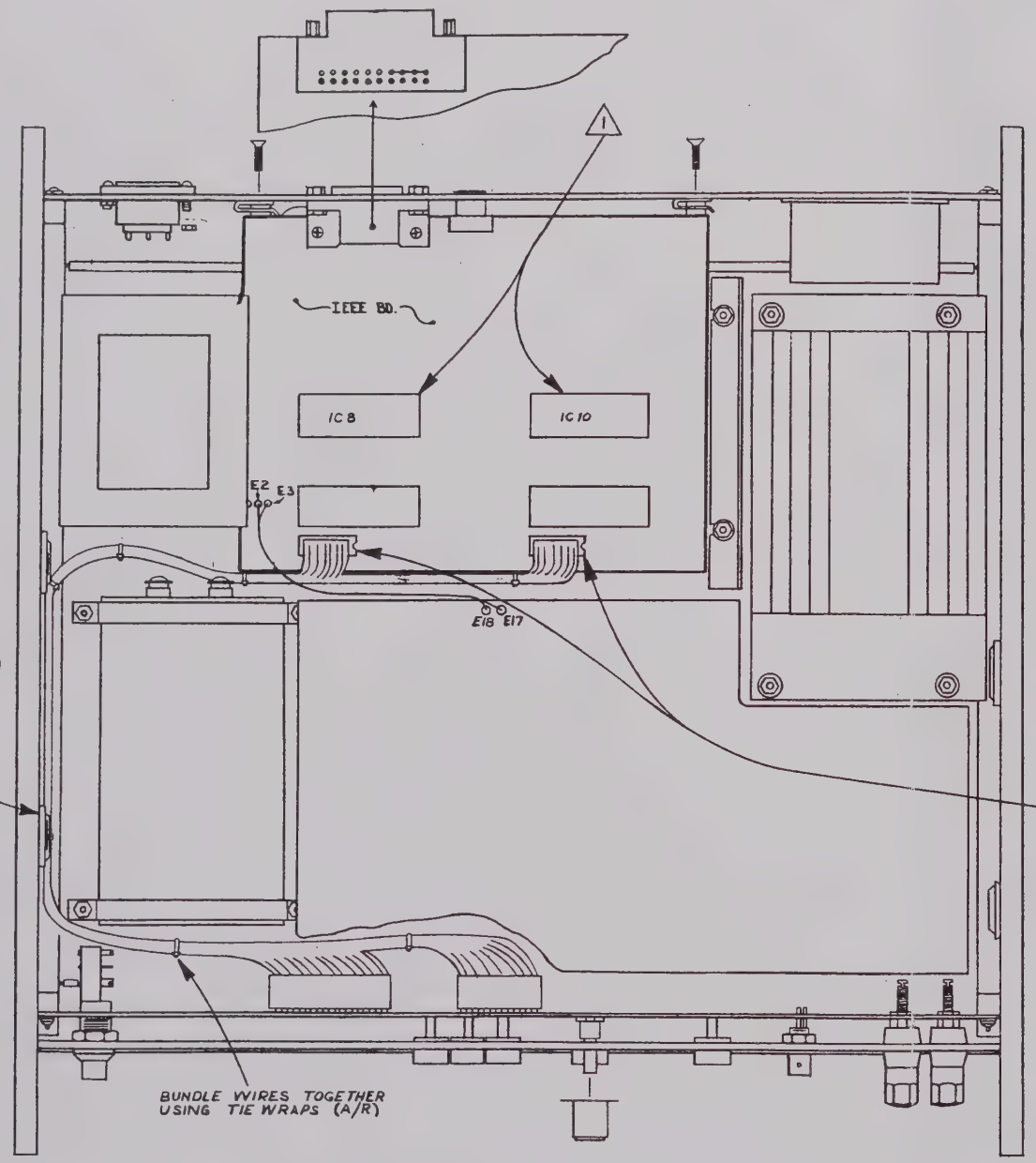
SHEET 1 OF 1

CODE IDENT	SIZE	DRAWING NO	REV
53504	D	4300-075	B

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. REMOVE IC 8 AND IC 10.
2. FOR PARTS LIST SEE 1300-103.
   FOR PCB ASSEMBLY SEE 1000-600.

REVISIONS				
ECO	LTR	DESCRIPTION	DATE	APPROVED



PL 3		1000
PIN	COLOR	
1	N.C.	
2	N.C.	
3	N.C.	
4	N.C.	
5	N.C.	
6	N.C.	
7	VLT	SK2-2
8	GRY	SK2-3
9	WHT	SK2-16
10	BLK	SK2-9
11	BRN	SK2-7
12	RED	SK2-15
13	ORN	SK2-14
14	YLO	SK2-17
15	GRN	SK2-8
16	BLU	SK2-6
17	VLT	SK2-13
18	GRY	SK2-12
19	WHT	SK2-10
20		

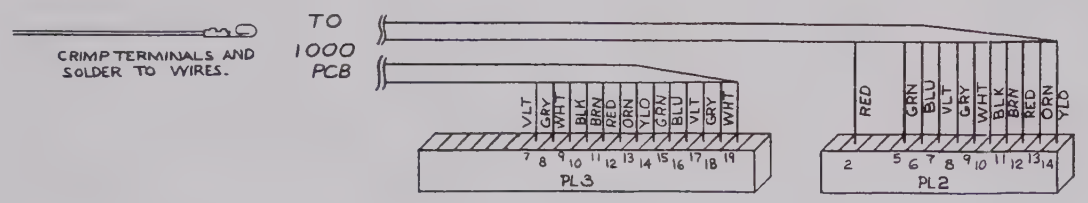
24 AWG WIRE.

PL 2		1000
PIN	COLOR	
1	N.C.	
2	RED	SK4-18
3	N.C.	
4	N.C.	
5	GRN	SK4-11
6	BLU	SK4-19
7	VLT	SK4-2
8	GRY	SK4-17
9	WHT	SK4-14
10	BLK	SK4-3
11	BRN	SK4-13
12	RED	SK4-12
13	ORN	SK4-15
14	YLD	SK4-16

24 AWG WIRE.

4300-602		1000-600
E17	TO	E3
E18	TO	E2

22 AWG WIRE. 6.5"


CRIMP TERMINALS AND SOLDER TO WIRES.
TO 1000 PCB
VLT GRY WHT BLK BRN RED ORN YLO GRN BLU VLT GRY WHT
7 8 9 10 11 12 13 14 15 16 17 18 19
PL3
RED GRN BLU VLT GRY WHT BLK BRN RED ORN YLO
2 5 6 7 8 9 10 11 12 13 14
PL2

DASH NO	QTY REQD	NEXT ASSEMBLY	USED ON

TOLERANCES
X = ± 30'
.XX = ± .03
.XXX = ± .010

BREAK ALL SHARP CORNERS AND EDGES, MACH SURFACES 64

MATERIAL

FINISH

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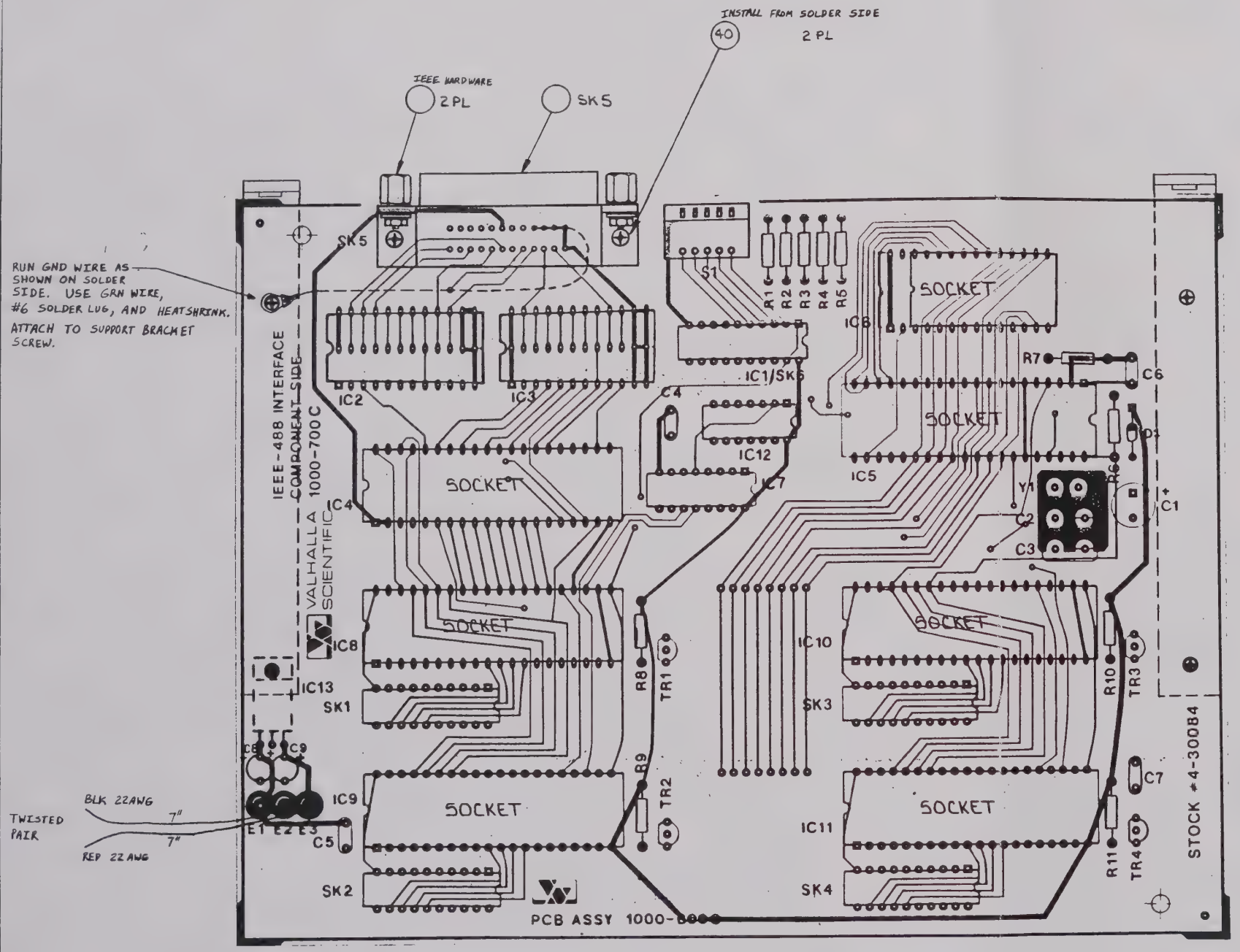
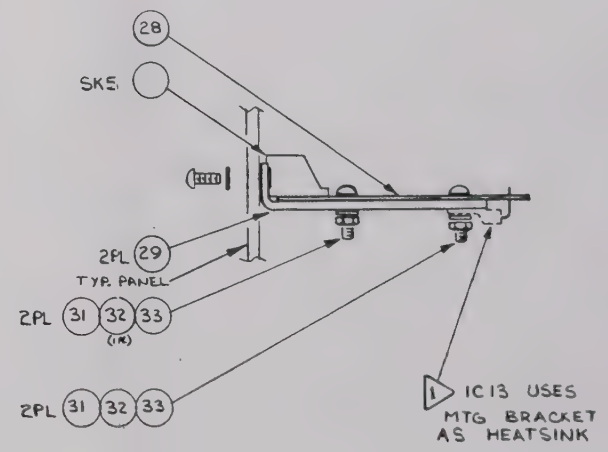
OPTION IEEE-TL 488 ASSY.

SCALE	SHEET	CODE IDENT	SIZE	DRAWING NO	REV
1 = 3/4	1 OF 1	53504	D	4300-403	J

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED





SHOWN IS P.C.B. ASSY 1000-600

NOTES:

1. COMPONENTS C8, C9 AND IC. 13 ARE ONLY USED IN UNITS HAVING LESS THAN 5V @ 1 AMP OF AVAILABLE POWER FOR THE IEEE P.C.B. CHECK PARTS LIST 1000-600-1 .
2. FOR SCHEMATIC SEE DWG. 1000-070.
   FOR 2300 SERIES, USE PARTS LIST 1000-600. (OPTION 72-4)
   FOR 4300B, USE PARTS LIST 4300-403. (OPTION 72-488)

MATERIAL		Valhalla Scientific Inc. SAN DIEGO, CALIFORNIA			
FINISH		ASSEMBLY- IEEE INTERFACE P.C.B			
SCALE 2/1	SHEET 1 OF 1	CODE IDENT NO. 53504	SIZE D	DRAWING NO. 1000-600	REV K

8 7 6 5 4 3 2 1

D C B A

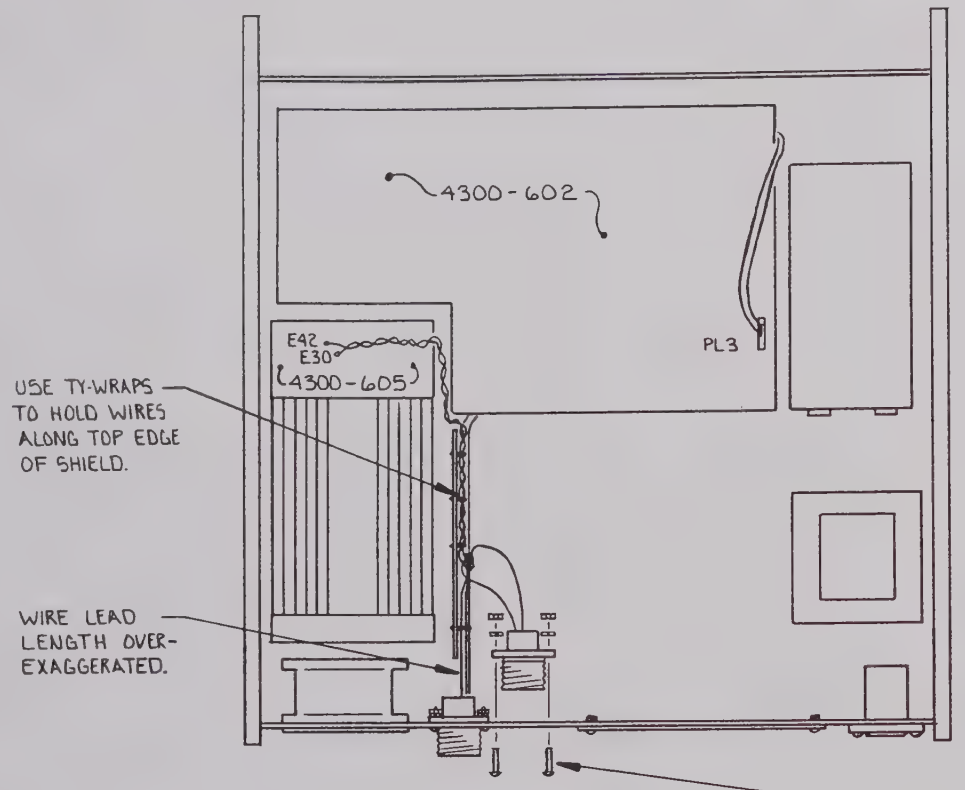
1000-600

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

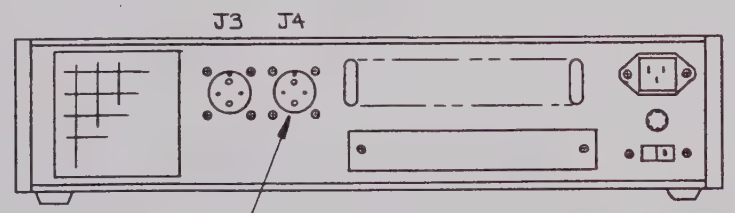
I.C. No.	+5V	GND ▽
1	20	10
2	24	12,13,14
3	1,24	11,12,13,14
4	20	1,2
5	2,3,6,8, 35,36	1,21
6	26,27,28	14
7	16	8
8-11	20,22,24	1
12	14	7

NOTES:
1. ALL RESISTORS ARE 1/4W, 5%.
2. FOR ASSEMBLY SEE 1000-600.
3. ALL PARTS NOT USED FOR OPTION TC-488. REFER TO P/L 4300-403.

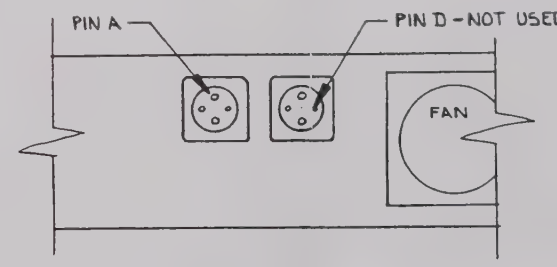
MATERIAL		Valhalla Scientific Inc. SAN DIEGO, CALIFORNIA		
FINISH		SCHEMATIC- IEEE-488 INTERFACE		
SCALE		CODE IDENT NO. 53504	SIZE D	DRAWING NO 1000-070 REV B
		SHEET 1 OF 1		



4 8 PL.
1 2 PL.
6 8 PL.
5 8 PL.



MOUNT CONNECTOR WITH KEY IN POSITION SHOWN



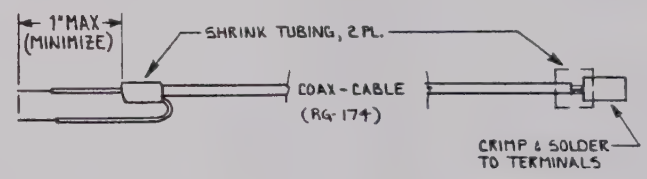
REAR VIEW OF CONNECTORS

NOTE CONNECTOR PIN LABELS, POSITION AS SHOWN.

WIRE TABLE

J3 - PINS B&C (SOLDERED) GOES TO 4300-605-E42 (SOLDERED) - RED
J4 - PINS B&C (SOLDERED) GOES TO 4300-605-E30 (SOLDERED) - BLK
RED & BLK WIRES ARE A TWISTED PAIR

J3 - PIN A (SOLDERED) COAX CENTER
J4 - PIN A (SOLDERED) COAX PIGTAIL
} GO TO 4300-602-PL3 (CRIMP TERMINAL & HOUSING)



DASH NO	QTY REQD	NEXT ASSEMBLY	USED ON

TOLERANCES
X° = ± 30'
.XX = ± .03
.XXX = ± .010

MATERIAL
SEE PARTS LIST

BREAK ALL SHARP CORNERS AND EDGES, MACH SURFACES
64

FINISH
~

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Valhalla Scientific Inc.
SAN DIEGO, CA

OPTION "JB-2"

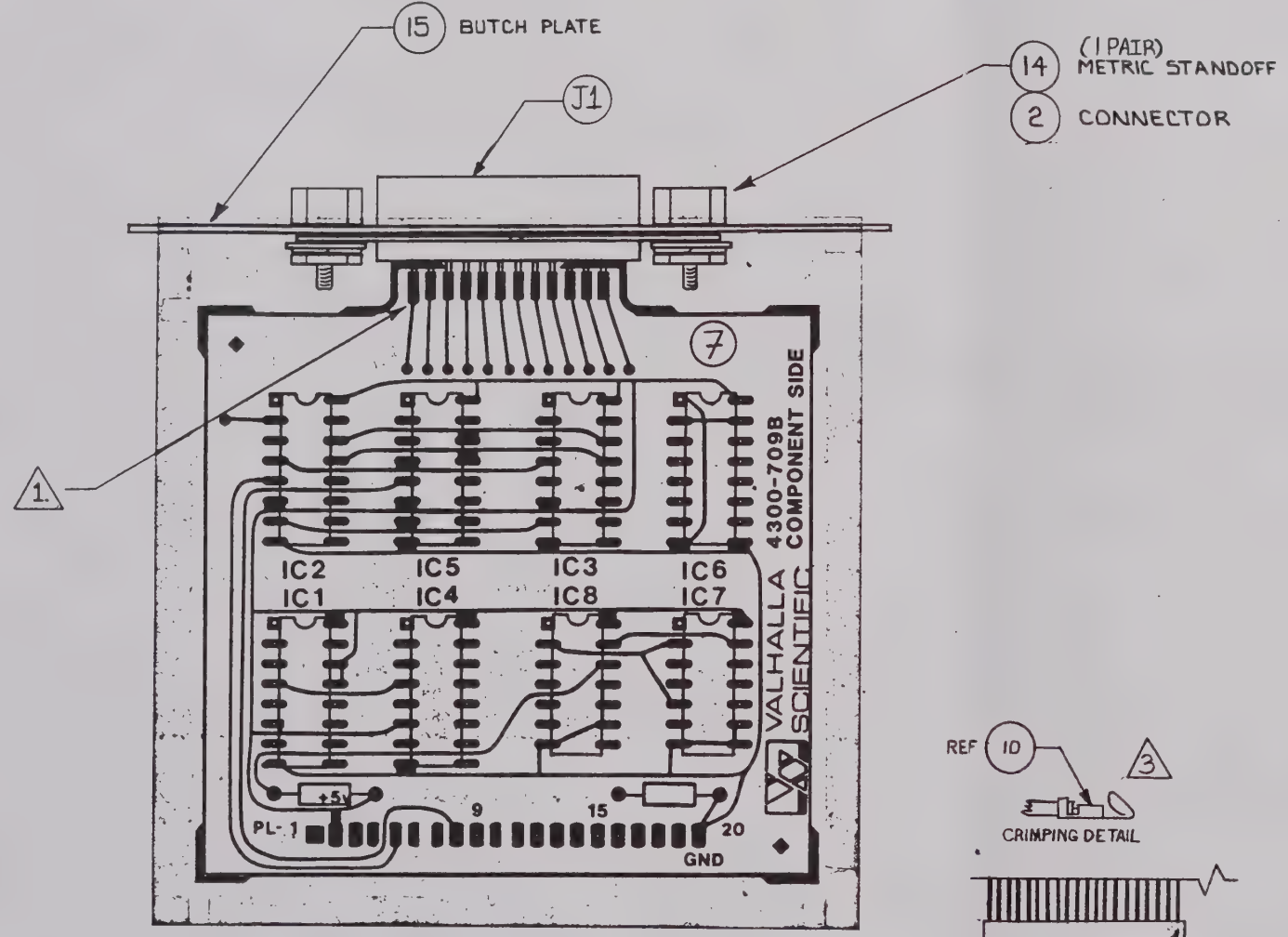
SCALE	CODE IDENT	SIZE	DRAWING NO	REV
NONE	53504	C	4300-407	D

SHEET 1 OF 1

4300-407

FOR PARTS LIST SEE 4300-609

REVISIONS				
ECO	LTR	DESCRIPTION	DATE	APPROVED

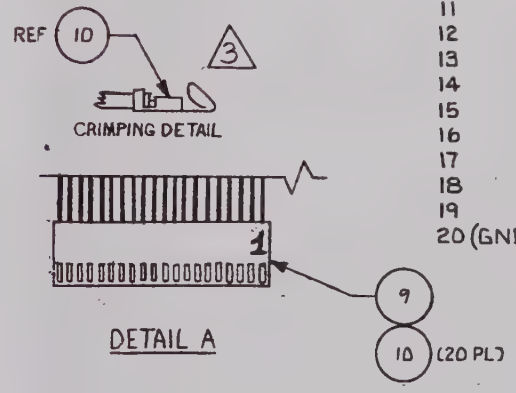


WIRING INFORMATION

4300B - INSTALL CONNECTOR AS SHOWN IN DETAIL A.

4201 - CONNECTOR AND TERMINALS ARE NOT USED.

FROM PL-1	WIRE COLOR	TO 4201 HOLES MARKED ◐	TO 4300B PL3-
1	BRN	NOT USED	4
2 (+5v)	RED	2	1
3	ORN	3	14
4	YEL	4	9
5	GRN	5	12
6	BLUE	6	13
7	VIO	7	17
8	GRAY	8	18
9	WHT	9	15
10	BLK	10	10
11	BRN	11	11
12	RED	12	16
13	ORN	13	3
14	YEL	14	2
15	GRN	15	5
16	BLUE	16	6
17	VIO	17	NOT USED
18	GRAY	18	8
19	WHT	19	7
20 (GND)	BLK	20	20



DETAIL A

NOTE:

1. ROUNDED PIN IS PIN 1.
2. MINIMUM LEAD LENGTHS ARE 24 INCHES.
3. CRIMP AND SOLDER

DASH NO	QTY REQD	NEXT ASSEMBLY	USED ON

TOLERANCES
X° = ± 30'
.XX = ± .03
.XXX = ± .010

MATERIAL

BREAK ALL SHARP CORNERS AND EDGES, MACH SURFACES 63

FINISH

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SAN DIEGO, CA

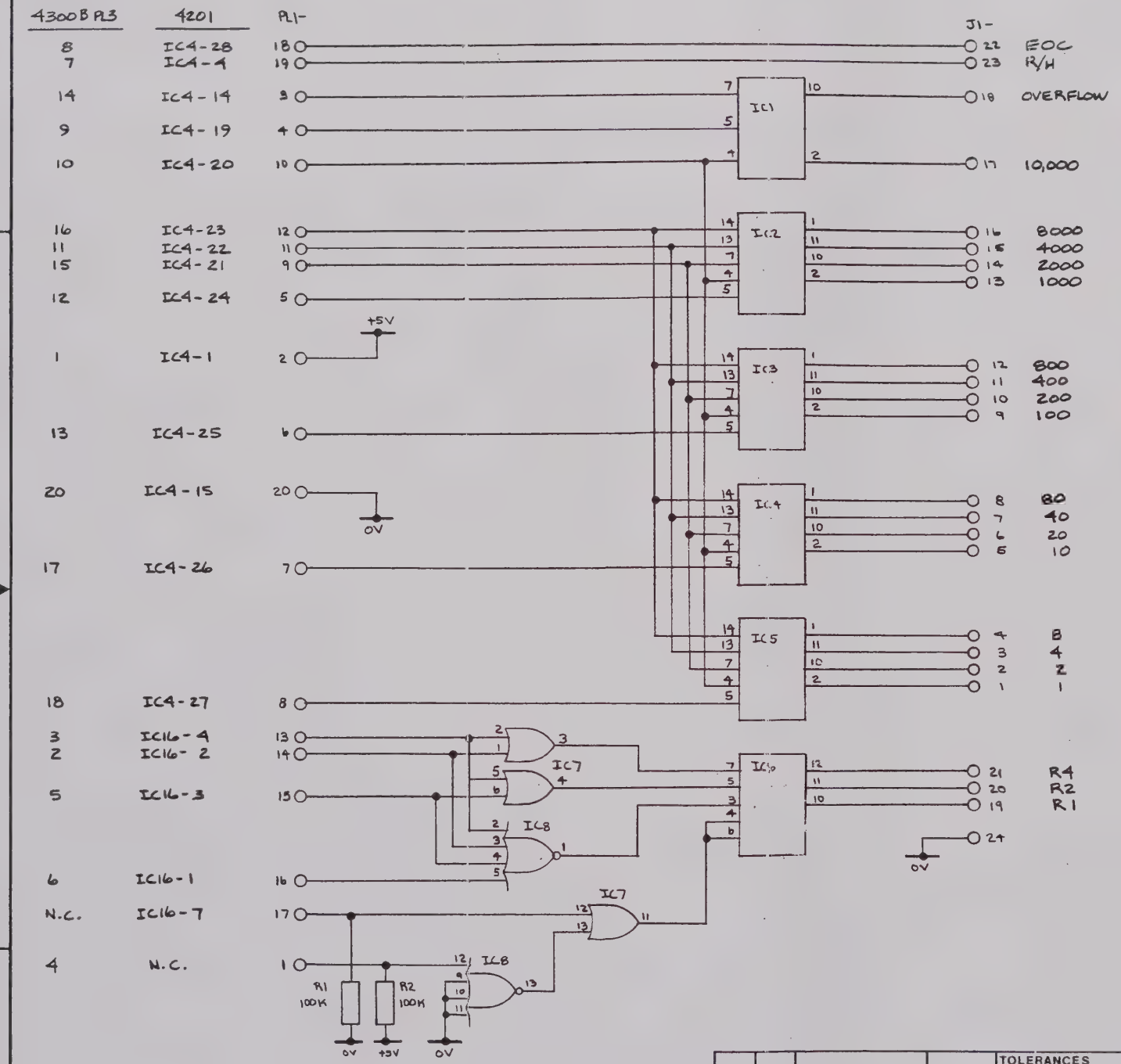
4300 BCD INTERFACE ASSEMBLY

SCALE	CODE IDENT	SIZE	DRAWING NO	REV
NONE	53504	C	4300-609	G

SHEET 1 OF 1

4300-609

REVISIONS				
ECO	LTR	DESCRIPTION	DATE	APPROVED
0305				



Power Connections

	+5V	0V
IC 1	6, 13, 14, 16	8
IC 2-5	6, 16	8
IC 6	16	15, 1, 2, 9, 8
IC 7	14	7, 8, 9
IC 8	14	7, 9, 10, 11

NOTES:

1. FOR P.C.B. SEE DWG 4300-609. FOR PARTS LIST SEE DWG 4300-609.

DASH NO	QTY REQD	NEXT ASSEMBLY	USED ON

TOLERANCES
X = ± 30'
.XX = ± .03
.XXX = ± .010

MATERIAL

BREAK ALL SHARP CORNERS AND EDGES, MACH SURFACES
64

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SAN DIEGO, CA

SCHEMATIC - 4300 B.C.D. INTERFACE

SCALE	CODE IDENT	SIZE	DRAWING NO	REV
—	53504	C	4300-079	C

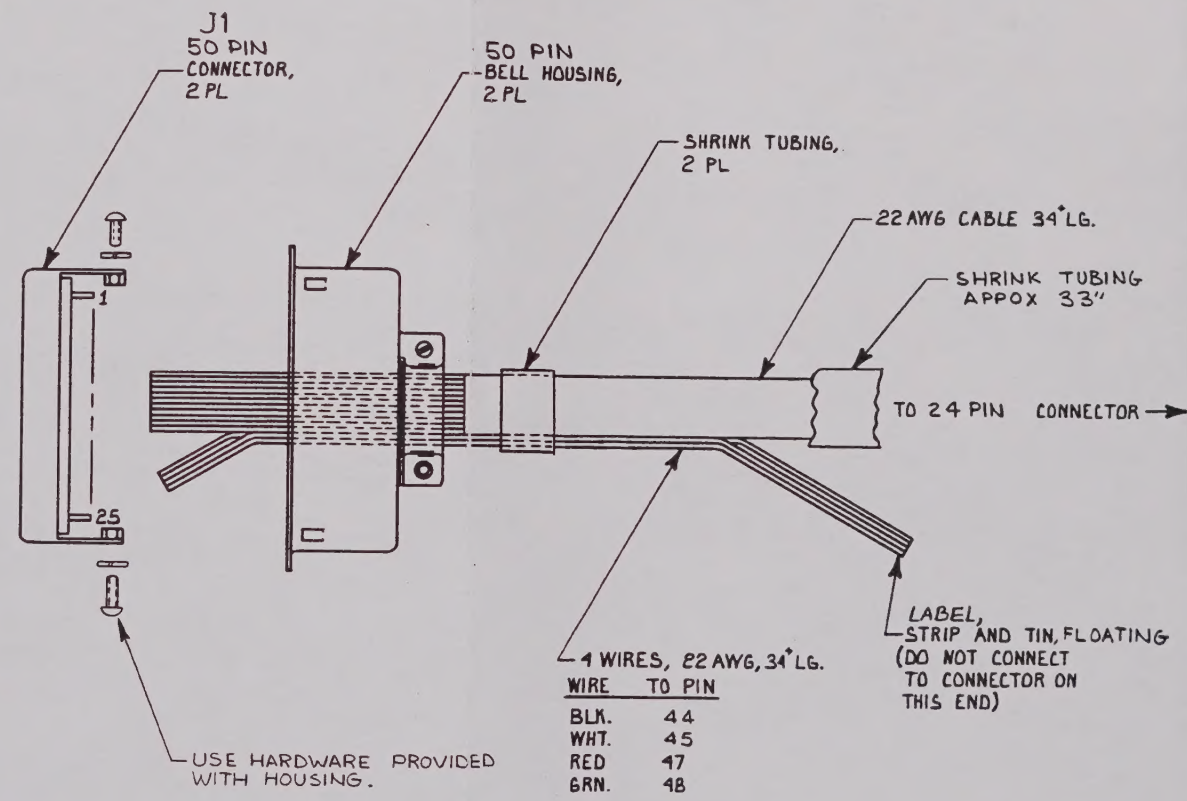
SHEET 1 OF 1

REVISIONS				
	LTR	DESCRIPTION	DATE	APPROVED

WIRING TABLE		
1248	4300	
FROM 50 PIN	TO 24 PIN	WIRE COLOR
1	1	RED BLK.
2	2	YEL. BLUE
3	3	GRAY
4	4	YEL WHT
6	5	PUR. BLK.
7	6	YEL. BLK.
8	7	BLUE BLK.
9	8	DR. BRN.
11	9	LT BRN
12	10	GRN.
13	11	DR. PUR.
14	12	ORN.
16	13	LT. PUR.
17	14	PINK
18	15	BLUE.
19	16	YEL.
21	17	RED
22	18	BLK.
23	24	BLK.
24	24	BLK.
26	N/C	+5V
29	24	BLK.
30	24	BLK.
31	24	BLK.
32	24	BLK.
33	24	BLK.
44	FLOATING	BLK.
45	FLOATING	WHT.
47	FLOATING	RED
48	FLOATING	GRN.
50	24	BLK.
5	24	BLK.
FLOATING	19	BLUE
FLOATING	20	ORN.
FLOATING	21	VIO.
FLOATING	22	YEL.
FLOATING	23	GRAY

WIRE BREAK-OUTS FROM J2 (24 PIN) END

✓STRIP AND TIN
✓LABEL WITH PIN #


J1
50 PIN CONNECTOR, 2 PL
50 PIN BELL HOUSING, 2 PL
SHRINK TUBING, 2 PL
22 AWG CABLE 34" LG.
SHRINK TUBING APPOX 33"
TO 24 PIN CONNECTOR → J2
1
25
USE HARDWARE PROVIDED WITH HOUSING.
4 WIRES, 22 AWG, 34" LG.
WIRE TO PIN
BLK. 44
WHT. 45
RED 47
GRN. 48
LABEL, STRIP AND TIN, FLOATING (DO NOT CONNECT TO CONNECTOR ON THIS END)

MATERIAL

FINISH

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Valhalla Scientific Inc.
SAN DIEGO, CALIFORNIA

OPTION I.D.C.-3
50 TO 24 PIN CABLE

SCALE	CODE IDENT NO.	SIZE	DRAWING NO.	REV.
1/1	53504	C	4300-051	D

SHEET 1 OF 1

Optico 279-0151

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